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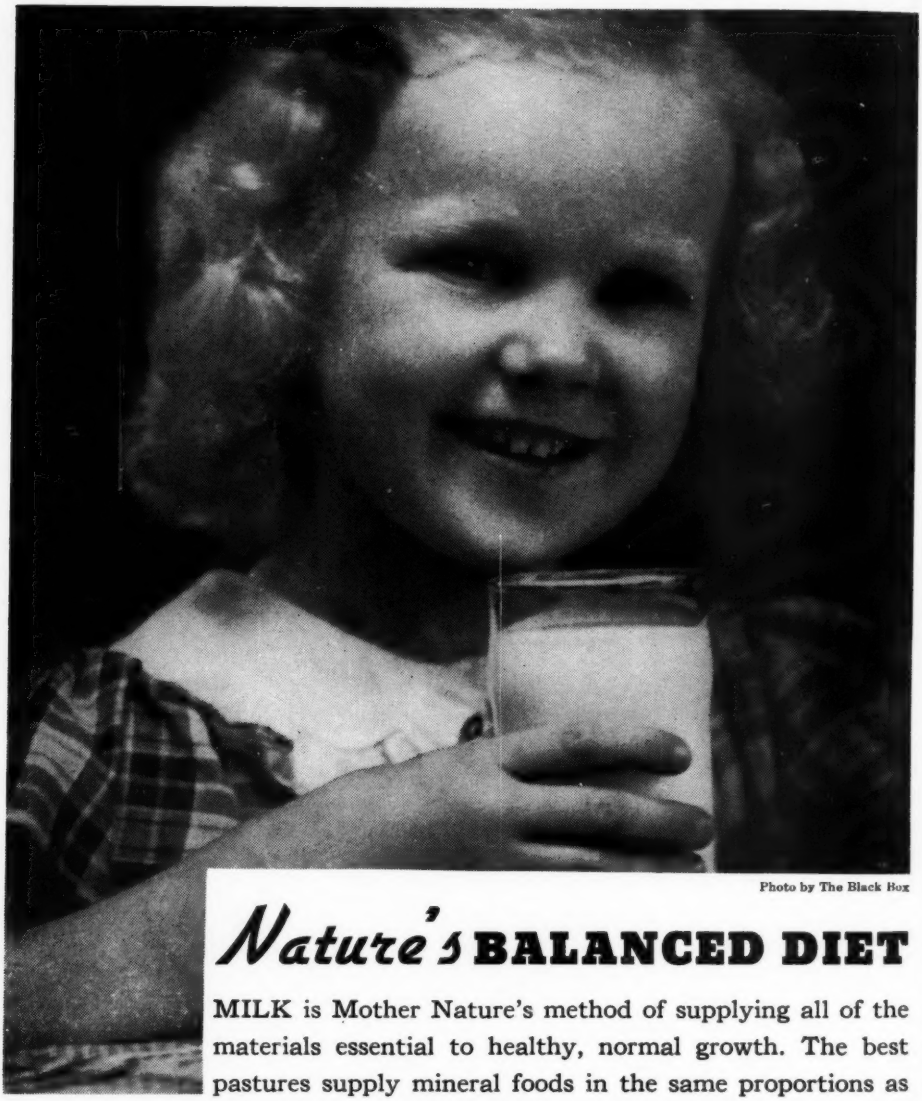

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Nature's BALANCED DIET

MILK is Mother Nature's method of supplying all of the materials essential to healthy, normal growth. The best pastures supply mineral foods in the same proportions as they are found in milk. This means that the pasture should consist of the proper ratio of grasses and legumes. All-legume pasture is undesirable because of too-high calcium content, and the pure grass pasture is undesirable because of its low phosphorus content. Potash is necessary to promote the growth of clover in pastures and therefore important in maintaining balanced grazing for the cow that makes the milk.

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

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American Potash Institute, Inc.
Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*
G. J. CALLISTER, *Vice-President and Secretary*

"'TIS WINTER NOW—BUT SPRING WILL BLOSSOM SOON."

Better Crops with PLANT FOOD

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Land Grant Landmarks

Jeff McDermid

SPEAKING of "better crops," the bumper yield per acre and per dollar of original investment in the whole history of American agriculture was harvested from an area of 6,300,000 acres of government land deeded by Abe Lincoln to the "non-collegiate common people" in July 1862. In spite of much sowing of tares by numerous enemies at dark and otherwise, that seed planted seventy-five years ago next summer has taken the record for purity and high germination test.

You have guessed it! I am reveling in another anniversary! What I lack in fundamental knowledge of the subject I hope to overcome and offset by a high degree of enthusiasm.

While 1862 was also significant for a document issued to free the slaves, Lincoln did not realize that the real emancipation proclamation was the one Congress presented to him, called the Morrill Act. His own battle for an education might have told him that, but the thundering guns of Antietam Creek were not conducive to academic reflections.

All victories for agriculture have been preceded by vetoes. Lincoln's predecessor, James Buchanan of Pennsylvania, had vetoed the land grant bill because there was no precedent for it, and it would cost the government $5,000,000 a year in "reckless extravagance."

Yet anyone comparing finances and

land area in relation to government intervention in farming would smile at Buchanan's fears of extravagance, and chuckle at the 6,000,000 acres as well. Any good corn-belt county absorbed more government funds than this in 1934-35, and five times the old land grant area was involved in crop-withdrawal contracts.

That the land grant act survived for two years after passage indicates to me that there must have been fewer job-seeking attorneys hovering on the fringes of Congress than there are today. That is, it is quite evident that there is just as much justification for putting agricultural training by federal support on the skids as there was in 1935 for thumbing down the project to adjust production through federal action. Of course, the real answer is that few persons of that day, with special privilege to protect, worried over the rapidity with which pioneer colleges could put new ideas in rural craniums. And it *did* take quite a long while at that!

THE germs of agricultural education and the chromosomes therein engendered were begotten amid tallow candles, quill pens, powdered wigs, flowered waistcoats, horn books and almanacs, oxen and flails, churchwarden pipes, tom and jerry, egg-nog, hard cider, and soft soap!

There was considerable gain in impetus from 1840 to 1850, in the era of private schools and public scandal, New England rum and protective tariffs, the cotton gin and the mint julep, compromise and conspiracy. It reached the climax in the two decades from 1850 to 1870 to the music of "Dixie" and "Hail Columbia," and persisted along with reconstruction, civil service reform, the trans-Atlantic cable, the transcontinental railway, redskin wars, and the supposed conquest of the Great American Desert. It grew apace in the epoch of the hickory shirt and the hoop skirt, the fading of the bustle and the bison, and the heyday of parlor organs, plug hats, carriage horses, and the Republican Party!

I PROPOSE to devote the space assigned to me in this number purely to high lights of progress toward the land-grant goal of 1862, with trimmings, and reserve the next issue to the foreground which offers as many vexing questions as the background.

It will do some good to the thinking elements of our land-grant staff to remind them that education is not worth a plugged nickel until such time as the people are ready for it. Our worthy dons of the colleges are often impatient at the sluggishness of enthusiasm amid the populace, for new libraries and laboratories. They forget that informal, spontaneous, independent agencies came before the formal systems of education, and that slow-growing trees usually have tougher fiber and deeper roots than seasonal saplings. Grabbing for miles instead of being tickled with inches is a too common fault of many a land-grant deacon. Looking at a few notches cut along the backward trail by timber cruisers in the woods of ignorance may send us back to classroom and farm better satisfied with conditions as they are on post-depression appropriations.

It may also remind us enthusiasts that the old-timers spent small sums and made great progress on them, while our ever-present liability is that we may show relatively less progress but leave plenty of debt behind for the youngsters to settle. If we don't approach history in a humble state of mind we are untrue to the spirit of land grant learning.

During the early part of the century in which the land grant colleges were founded, there were more big hearts and huge hands than stupendous heads. Every-day folks

needed courage, hope, and muscle, and they regarded the gentle art of absorbing culture from "dead lingoes" as a graft for preachers, lawyers, and doctors.

Trail makers who left the east coast for the wilderness left ministers,

attorneys, and physicians behind them; and when their later settlements afforded a place for "luxury," they took the professions into their hamlets and usually measured the weight of law, morals, and healing by the amount of mystery which sonorous Latin and Greek phrases suggested, or the slumber they produced to ease the weary frame.

TRADITIONAL and classical education held sway for half a century after the Revolution. Grubbers and wanderers had little desire for it, but they paid well for its inception to others, in one way or another, just the same. The light of knowledge shone for the church and the courtroom, never for the forge and the farm. Esthetic doctrines paved the way for life in the next world, but left the living man to guess and grope.

Education in those times was for the soul and the body, seldom for the land, because when land wore out more could be had simply by moving like the aborigines to fresher stamping grounds. Only when avenues of escape are cut off do folks learn to make the best of what they have, or perish.

BUT educated minds breed more education. Such persons are uneasy until others know as much as they do, or maybe a trifle more. This remarkable generosity is the real secret of the growth of land-grant colleges. Peering back into colonial and early republic days, we find that industrial and agricultural education sprang from educated landed squires and country gentlemen, or lawyers, ministers, and editors. They could not sit and wait for the legislature or the A. F. B. F. to endorse some ambitious scheme. Instead they kept pounding away in their several corners on some flowery text like this: "Arrest not then by your apathy the progress of agriculture. Its improvement is the amelioration of the lot of thousands yet unborn." Yet their ideas were regarded by ordinary mine-run farmers as they look upon golf today—an imported pastime for harmless idlers.

Initiative, growth, equality of opportunity, and helpfulness are what Americans demand of educational institutions.

All of these are manifest in the work of those early original exemplars of practical training and research. Nowdays we turn a cold shoulder to rugged independence or profess to, but this attribute of the founders can never be excelled by the pressure groups we now so widely encourage.

In hustling around for themselves and others seeking a new deal in farm-

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Mineral Fertilizers for Pasture Improvement

By Howard B. Sprague
New Jersey Agricultural Experiment Station, New Brunswick, New Jersey

THERE has been a notable change during the last 10 years in the attitude of agricultural leaders and farmers toward pastures. Largely neglected or ignored in 1926, permanent grazing lands are now generally recognized as the greatest agricultural resource of the northeastern quarter of the United States. Numerous experiments conducted in various sections to determine suitable methods of soil treatment and grazing management are beginning to show concrete returns on farms in the form of lower milk costs and reduced feed costs for beef cattle and other livestock.

In spite of long neglect, with proper soil treatment there are great opportunities for remarkable returns from pastures. An illustration of this type of response is found in New Jersey experiments conducted on Chester gravelly loam, an upland soil derived from gneiss rock. The average yields of clippings taken at 2-week intervals on these pastures during the grazing season for a 3-year period (1929-31) following a single treatment, were as follows:

An application of 1,000 pounds of an 0-10-0 fertilizer and 1½ tons of limestone produced sod mostly grass.

Treatment	Acre Yields of Dried Clippings 1929-31	Per Cent Relative Yields of Clippings	Per Cent Clover in Vegetation
None	2,120 Lbs.	100.0	3
Lime alone	2,338 Lbs.	110.3	7
Lime and superphosphate	3,167 Lbs.	149.4	19
Lime, superphosphate, and potash	3,803 Lbs.	179.4	31

In these tests the rates of application were 1/3 ton of hydrated lime, 600 pounds of superphosphate, and 100 pounds of muriate of potash applied in the early spring of 1929. Using prices as of March 1936, the cost of these materials was $9.37 in contrast to the value of the extra feed produced by the complete treatment for the 3-year period, which would total $81.90 when purchased as concentrate feeds.

The increase in total yield was only one phase of the improvement produced by mineral fertilizers. Of even greater importance was the beneficial change in the seasonal distribution of growth. The complete mineral fertilizer stimulated growth 2 weeks earlier than on untreated plots, and also continued feed production at a much higher level during the months of July and August when permanent pastures are usually short. The no-treatment plots produced 29 per cent as much feed during the period of feed shortage (July 17-August 28) as in the flush period (May 8-June 19). By a contrast, the mineral treatments averaged 52 per cent as much in the short period as during the flush period. It should be noted that the years covered by these observations were comparatively dry during the 3 summer months.

Mineral treatments also improved the palatability and feeding value of the herbage. On unfertilized areas

Wild white clover predominated in the sod receiving 1,000 pounds of 0-10-10 and 1½ tons of limestone.

the surplus growth not consumed promptly by grazing cows soon became unpalatable and persisted through the summer as clumps of mature plants, avoided by livestock and occupying areas that might have been producing palatable feed. On the other hand, the treated areas were entirely palatable at all seasons, and the excess growth containing large amounts of clover not consumed during the peak period of growth was quite palatable at a later date. On the plots mowed regularly, the protein content of the untreated areas averaged 14 per cent, while the dried herbage on the treated plots increased in protein to 20 per cent.

Following these experiments, a comprehensive system of pasture management was put into effect on this farm for the entire grazing area of 105 acres. The returns in increased feed production have fully equalled the expectations based on these tests. With two additional fields of cultivated land assigned to the production of temporary pastures in July and August, to supplement the permanent grazing lands, this farm is now producing nearly all of the feed required for approximately 70 high-producing milk cows and 75 dry stock and calves for approximately 6 months each year.

Complicating Factors

It is unfortunate in some respects that such simple soil treatments as those outlined above cannot always be relied on to produce equally satisfactory returns. Several factors complicate the situation. On some soils, imperfect drainage, and on others, low water-holding capacity and susceptibility to drought limit the response to mineral fertilizers. In addition, it is frequently found that soils have been too badly depleted by many years of neglect to show such prompt response to mineral treatment. This is illustrated by a permanent pasture on Collington loam, an adequately-drained, coastal plain soil that had received no soil treatment for many years. Applications of lime, phosphate, and potash, alone and in combinations, failed to produce any increases in yield greater than 20 per cent during the following 3-year period.

Time of Application

Since this failure to respond satisfactorily to mineral fertilizers is a condition found on many pastures, it was planned to make a further study of this soil under controlled conditions in the greenhouse. The soil was uniformly screened and placed in pots, and a sod of mixed grass and clover established on the entire series. The fertilizers were then applied as top-dressings to all but one group of pots, to simulate field conditions. The resulting yields of clippings were similar to those obtained in the field. On one series, however, lime was incorporated with the soil at the beginning of the experiment, and minerals were applied as a top-dressing 3 months later. The effect was phenomenal; the yield under this treatment was 210 per cent of the untreated pots, in contrast to 120 per cent for those receiving lime and minerals simultaneously as a top-dressing, and 123 per cent for pots with lime and minerals incorporated with the soil immediately before seeding.

The entire series was allowed to become dormant for a period, to resemble winter field conditions, following which a second season of growth was produced. The yield for the second growth period, in pots where lime had preceded the use of phosphates and potash, was 150 per cent of the untreated pots, in contrast to a yield of 142 per cent for pots which had received simultaneous top-dressings of lime, minerals, and nitrogen. Clover

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Potash for Cotton in The Delta Foothills

By Roy Kuykendall
Delta Experiment Station, Stoneville, Mississippi

THE Delta foothills section of Mississippi includes that strip of land about 10 miles wide and 200 miles long, adjacent to the hills on the east, beginning at the Tennessee line, and extending southward through Tunica, Panola, Quitman, Tallahatchie, Leflore, Carroll, Holmes, Humphreys, Yazoo, Issaquena, and Warren Counties. The eastern portion of this section is the foothills proper. The soils are built chiefly from soil materials from the bordering hill section. They are mostly sandy loams. The west part of this strip of land is located in the Coldwater - Tallahatchie - Yazoo River basin which separates the foothills proper from the delta proper. These soils are made up of varying mixtures of soil material from the Mississippi River drainage basin and deposits from the rivers rising in the adjacent Mississippi hills. They contain less sand than the other group.

Experimental results indicate that for profitable crop yields the soils of the hill section are deficient in all of the major fertilizing elements—nitrogen, phosphorus, and potash—whereas the soils of the delta area proper are deficient only in nitrogen. The soils of the delta foothills region, therefore, may be expected to show a shortage of potash and phosphorus in proportion to the mixture of the deposits from the Mississippi hill streams and those from the Mississippi River.

In this section very little potash has been used in the past, therefore a huge potash deficiency has apparently accumulated throughout the area. This potash deficiency in the

The shaded area represents the Delta foothills section of Mississippi.

foothills area proper is plainly visible when driving down through this area in August and observing thousands of acres of cotton heavily damaged by potash hunger or rust.

potash. The potash not only increased the cotton yields, but caused the bolls to mature better and open more fully, which increased the ease of picking.

The results of these potash tests are

Farmers inspecting potash fertilizer experiments in the Mississippi Delta foothills.

To determine the fertilizer needs for these soils more fully, the Delta Experiment Station, Stoneville, Miss., initiated a program of cooperative research with farmers at several different locations in the foothills region. Thus far six experiment fields have been located and work begun with the following planters: W. S. Atkinson, Valley, and Marx Schaeffer, Yazoo City, for the southern area; L. S. Hemphill and Hugh L. Gary, Greenwood, for the south central area; and Tom Ladd, Charleston, and Whitney Smith, Webb, for the north central area. Two fields are to be located in the northern area.

Potash Controls Rust

In these experiment fields, tests are being conducted on cotton, with several sources of commercial nitrogen, winter cover crops, elimination fertilizer tests, variety and new strains comparisons. One of the outstanding things that has been accomplished to date is the control of rust and increased yield of cotton by the use of

presented in the following table. Nitrogen represents 45 pounds of nitrogen from 219 pounds of ammonium sulphate per acre. Phosphorus represents 45 pounds of phosphorus from 225 pounds of 20 per cent superphosphate per acre. Potash represents 37.5 pounds of potash from 75 pounds of 50 per cent muriate of potash per acre. All fertilizers were applied in the drill in the spring before planting.

The Atkinson, Hemphill, and Ladd fields are located on the very sandy soils in the foothills proper, and the Schaeffer, Smith, and Gary fields are in the Coldwater-Tallahatchie-Yazoo River basin.

In two of the fields, Atkinson and Ladd, in the foothills area, potash increased the yields 447 and 266 pounds of seed cotton per acre, or 38 per cent and 20 per cent respectively, in 1936. The 2-year average increase for potash at the Atkinson field is 356 pounds of seed cotton per acre, or 38 per cent more than nitrogen alone. Valuing seed cotton at 4c per pound,

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The Family Garden Deserves Planning

By W. B. Ward

Horticulturist, Purdue University Agricultural Extension Service, Lafayette, Indiana

A GOOD garden should not only be a means of supplying food for the family as an aid in decreasing the living costs but should supply quality produce for daily use at a minimum expense. The family gardener who desires fresh vegetables and small fruits in season, with a surplus for canning or storing, should plan the garden long before the first planting date arrives. The best farm and home garden records in Indiana come from those gardens which were carefully planned on paper, and a definite plan followed throughout the season.

Intelligent planning is based upon the knowledge of planting dates, the space required for the best development of the plant, and the length of time required from seed or transplanting time until maturity. With this information in mind, the garden may be planted to some crop or other from early spring to approximately 30 days before the expected frost in the fall, as oftentimes succession plantings of the same variety are more successful than the first. Sufficient seed should be ordered early, and only such vegetables planted as the family will eat. It is advisable to keep posted on the better varieties, as seedsmen are continually improving certain strains, and as soon as a better variety is on the market the older one should be discarded.

It has been the custom to garden certain parts of the entire farm, with the small kitchen garden close to the house, and sweet corn, tomatoes, and cabbage in various truck patches scattered to the other three corners. These scattered truck patches were cultivated only when convenient, the rows were spaced far apart in order to permit the use of horse-drawn cultivators, and the vegetables handled like any general farm crop. If some plants were trampled by the horses or plowed out it seemingly made very little difference to some, as they perhaps thought there were a few too many plants anyway.

The present trend is for more compact and well-arranged gardens so they may be easily cultivated with a wheel hoe, dusted or sprayed to control any sudden threats from insects or diseases, and at the same time cared for with the smallest expenditure of time or labor. Perennial vegetables, like asparagus, rhubarb, winter onions, and berries, should be planted along the sides of the garden so as not to interfere with either the plowing or cultivation.

Supply Nutrients

Intensive gardening removes considerable plant foods from the soil. The garden area may be brought back to a high state of fertility by an annual application of manure and commercial fertilizers. Manure may be used at the rate of 20 to 30 loads per acre as an annual application. The manure should also be supplemented with other fertilizer containing phos-

phoric acid and potash especially, and oftentimes nitrogen is necessary. Perhaps 500 pounds per acre of a complete fertilizer containing from 2 to 4 per cent nitrogen, 10 to 12 per cent phosphoric acid, and 6 to 8 per cent potash would give the best results, although a sack or two of any fertilizer on the farm when applied to the garden would be beneficial. Fertilizer may be applied before plowing and the garden soil plowed from 8 to 10 inches deep. Lime is of particular value in the case of acid or heavy clay soils. A mellow garden soil with plenty of plant food may be gardened for years, and this type of soil is well adapted to wheel-hoe cultivation.

Equipment

The small, well-constructed, and sturdy wheel hoe is finding great favor among the gardeners. Wheel-hoe handles should be long, adjustable to the height of the person using the tool, and have a small wheel and shallow cutting sweeps as standard equipment. The investment in a good wheel hoe is a little more than the cheaper ones, but in the long run the better tool will last from 20 to 30 years or longer, with better service.

Wheel-hoe cultivation permits closer row plantings, and such vegetables as beets, carrots, onions, etc., may be spaced so that once through with the wheel hoe will take out the weeds and leave a good mulch. For other crops that require wider spacing, two and sometimes three times through are necessary. The more vegetables planted to a given area, the less room will be allowed for the weeds to grow, and the ground will be shaded by the foliage of the desired plants. Shading of the ground does not permit excessive evaporation of moisture only but also is an aid in preventing the organic matter from "burning out" from the soil.

Nutrition specialists suggest that each family should have on hand approximately 60 quarts of canned vegetables, or its equivalent, and 49 quarts of fruits for each adult member of the family, this amount of food to be consumed during the off-garden season, a 7 months' period from October to the following May for the north central area. This 7 months' food budget may be supplied from the well-planned garden.

Those families with young and growing children will find that the boy or girl will consume as much fruit and vegetables as an adult and, therefore, should be counted full measure. On this basis, a family of four would require 240 quarts of vegetables and 196 quarts of fruits, or a total of 436 quarts, for the winter, canned, stored, or purchased. The vegetables used are listed in the order taken from the farm and suburban home garden questionnaire, and show that the potato ranks first. Tomatoes, green beans, cabbage, lettuce, corn, peas, onions, carrots, turnips, beets, pars-

Thorough and timely applications of either a spray or dust control the pests. This young gardener is applying dust on the underneath sides of bean leaves to control the Mexican bean beetle.

nips, spinach, sweet potatoes, and salsify follow in order of importance. Lettuce is generally purchased from the store; tomatoes, beans, corn, peas, spinach, and sometimes kraut and beets are canned, while the rest may be successfully stored and used fresh rather than canned. Of the fruit products, grapes and the berries rank first, followed by peaches, pears, plums, and apples. With the exception of apples, practically all of the fruit is canned. The storage budget should also be based upon the per capita consumption, and the following amounts are suggested for storing for each adult:

No garden is complete without a strawberry patch. Four hundred ft. of row produced 450 qts. of berries for "Skippy."

Potatoes	3½ bu.
Sweet potatoes	¼ "
Carrots	¼ "
Turnips or rutabagas	¼ "
Beets	½ pk.
Onions	½ "
Cabbage	20 lb.
Apples	1 bu.
Popcorn (on cob)	½ "
Nuts (hickory, walnut)	½ "
2 large pumpkin or squash	
Small squash	½ "

Parsnips and salsify may be left in the ground over winter or dug in the late fall and buried.

How much is actually canned and stored by the average family from home-grown produce is shown from 3,672 garden records. The average size of the family is approximately 4 people. This past year each family averaged 95.6 quarts of vegetables and 84.1 quarts of fruit. Two thousand five hundred and one families stored 48,323 bushels of vegetables, and 968 stored 8,589 bushels of apples and pears. Besides the home-grown produce, 1,221 families purchased 71,397 quarts of vegetables, and 2,061 families 142,947 quarts of fruits. Another interesting note came from the questionnaire in that 1,576 families reported canning 75,360 quarts of meats, some reporting that the chicken especially came from the garden.

Favorable Returns

Two of the numerous reports received this past season list: (1) 8 in the family, 509 quarts of vegetables and 380 quarts of fruits canned from home-grown produce, 40 bushels of potatoes, 12 pounds of dried corn, and several pumpkin and squash stored for winter use; (2) family of 3, 163 quarts of vegetables, 80 quarts of fruits, 55 bushels of vegetables, 5 bushels of fruit, 30 pumpkin, and 15 large squash stored, and 19 quarts of canned fruit purchased. Forty quarts of meat were also canned. At the bottom of the page this interesting note was added from the No. 2 report: "I had two new daughters-in-law this summer, so I raised enough from our garden so they could can 146 quarts of vegetables and 100 quarts of fruits."

The garden now plays a very important part in the happy family life. Not only are quality products grown and a saving shown on the expense account, but there is also a lot of real enjoyment in knowing that a good job was well done.

Andrew W. Milnar of Kimmel, champion onion grower of Indiana, has just been crowned monarch of the Onion Growers of America at their convention held at Kalamazoo, Mich. He grew 1,471 bushels on 1 acre and fertilized with 500 pounds of 0-20-20 broadcast and 300 pounds 2-8-16 in the row.

Meet Indiana's 1936 Onion King

By Roscoe Fraser

Muck Crop Specialist, Purdue University Agricultural Extension Service, Lafayette, Indiana

"THE value of fertilizer in an onion crop cannot be overestimated," is the advice that Indiana's 4-time Onion King gives to his fellow muck-crop producers, as derived from his experiences in ascending to the high position and later to prevent abdication from the throne.

Production practices employed by Andrew Milnar, better known as Andy, in attaining the honor of having grown championship yields of onions on muck soil for 4 years are unusually interesting. Surely the fact that "he knows his onions" cannot be disputed, and equally as safe should be his advice on the matter of what things or conditions are required not only to produce record yields of onions and other muck crops, but to produce yields as practicably and economically as possible.

And so, it is with the idea that what Andy found to be satisfactory would be equally as valuable to the "average muck-crop farmer" that I

am desirous of passing on some of my observations. Before I go into some of the things that our Indiana King did to get such a corner on the state's onion crop, it would be well to give a bit of his background.

Turning back the calendar to the fall months of 1922, when the future course of the nation's agriculture was not absolutely clear in the minds of farmers, we find young Andy a lad, shy of his majority by 4 years. At that age, he became associated with the produce business, joining the firm of Dingfelder and Balish in New York City in the capacity of a stenographer and assistant bookkeeper. When the firm enlarged a few months later, the Indiana Onion King in the making was promoted to the position of bookkeeper and later to office manager. More onion facts were collected while serving in the capacity as an assistant to one of the firm's owners from 1928 to 1930.

Then the great depression began to break out like chicken pox. There followed a series of fast-breaking events that greatly changed the scenery for Andy, giving him the opportunity of his life, though he probably didn't think so at the time. The duty on onions was raised. Foreign business dropped to a point that caused a reorganization in the firm that Andy was with. The company decided to set up subsidiaries in various onion-growing sections of the country. And, the next thing Andy knew, he was on his way to Kimmell, Indiana, in Noble County, to manage one of the farms.

Now, what would a young fellow, who had spent most of his time dealing with onions in the office or on the New York docks, know about producing a successful commercial crop, especially on Indiana's muck land? Here's what Andy has to say about his record since he has had his feet on "the promised land":

"The first year here I spent mostly getting acquainted, since field work was entirely new to me. In 1931, I experimented, using imported seed and plenty of commercial fertilizer, and won the state onion championship for the highest yield on 1 acre, as well as sweepstakes on my sample shown at the Indiana Muck Crops Show that year. We repeated the championship yields during the years of 1932 and 1933."

Set New Record

This year's record was a production of 1,471.98 bushels of U. S. No. 1 onions on 1 acre of well-managed, properly-fertilized, Indiana black muck land. That yield was nearly a couple of hundred bushels above his nearest Indiana competitor in the 1,000-Bushel Onion Club, a Hoosier agricultural extension project, thus winning the "Onion Crown" from eligible Indiana farmers for the fourth time since 1930. This time he established a new high yield for onions. And that is not all, he won the national onion grower championship.

How did Andy grow the enormous onion crop on a single acre? What

(*Turn to page* 34)

Interested critics of the prize crop, the author, the winner, and county agent M. A. Nye.

The Tung Oil Industry In Mississippi

By Ben Hilbun
Agricultural Experiment Station, State College, Mississippi

THE warm soil of south Mississippi that nourished great forests of long-leaf pine trees, now almost gone, may furnish the state another great industry. Tung trees, brought here as an experiment from ancient China, have buoyed hopes of an industry that some think will rival the lumber industry which, after running its course, left thousands of acres of cut-over lands a burden to those who own them.

Grown wild in the great Yangtse Valley of south central China at least 2,838 years B. C., tung trees have been considered, until recent years, as belonging by natural decree to that country. However, in 1907 a few of these trees were brought to the United States for experimental purposes, with the Chinese, in attempting to protect their ancient monopoly of tung oil, saying the United States could not compete with them because of their labor prices of 10 and 12 cents per day.

Increasing Supply

A few tung trees were planted at the Poplarville, Miss., Branch Experiment Station in 1927, but little or no attention was given them until 1932. Then Dr. J. C. Robert, director, became interested in the plant that bids fair to revolutionize the agricultural industry in the southern part of the state, provided experience does not destroy the faith leaders now have in the possibility of tung oil as a major cash crop for the section.

From the beginning of a few trees planted largely through curiosity in 1927, the plantings in Pearl River County have mounted to 50,000 acres, and an expansion program has been launched to add 50,000 acres by the end of 1937, ten years after the first planting. If given reasonable care, by the fifth year a tung tree orchard should produce 1 ton of nuts per acre. The nuts pan out about 25 per cent oil, which sold this year for an average of 15 cents per pound.

Growing Demand

Using the cotton crop and tung oil acreages in 1935 as a means of emphasizing the potential importance of tung oil as a cash crop, Dr. Robert compares the $115,000 cotton crop with the 30,000 acres of tung trees. At five years old the tung trees should produce a ton of nuts or 500 pounds of oil per acre, which at 10 cents per pound would amount to $1,500,000. "We are not saying," Dr. Robert added, "that these figures will hold true on all plantings, but from every indication it appears that the tung oil industry is either a great mirage or a coming industry for the southern part of Mississippi."

"The United States in 1935," Dr. Robert said, "used 120,000,000 pounds of tung oil, and produced less than one-half of 1 per cent of that amount. Half of this was produced in Pearl River County, showing conclusively that there is a great demand for the product. Present demand,

however, is not to be considered the ultimate possibility of the industry, since new uses for tung oil are being discovered, thus adding to the potentialities of this potentially great industry."

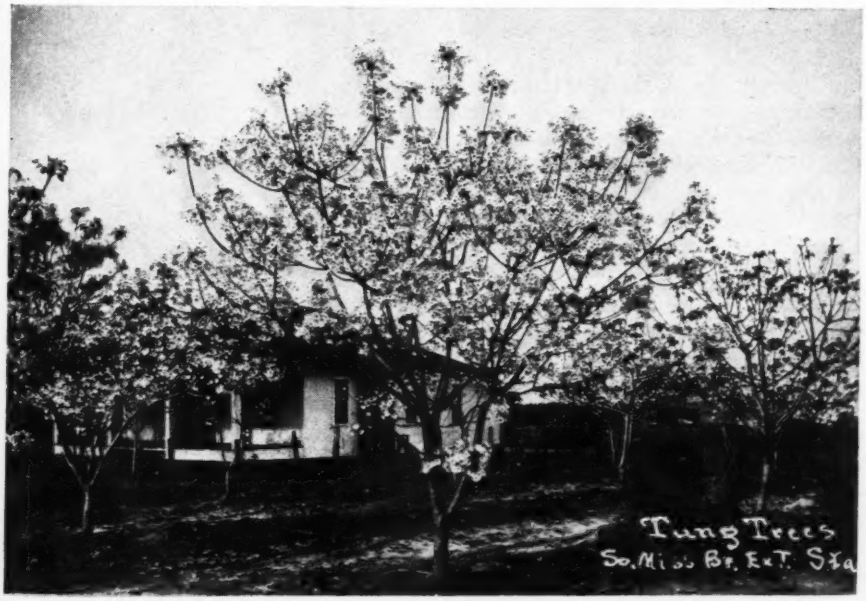
Among the 100 or more commercial commodities that contain tung oil are paints, varnishes, lacquers, various water-proof materials, such as oilcloth, umbrellas, linoleum, rubber shoes, brake linings for automobiles and railway equipment, synthetic rubber, and communication equipment. Ashes of tung nuts, from which the oil has been extracted, are used in the manufacture of the so-called India ink. The oil, which dries with a hard finish, is also excellent in protecting objects from weathering processes that normally cause chemical deterioration.

Tung oil has been used in the manufacture of paint for about 50 years. It has been shipped from Japan for about 40 years and for a while was known as Japanese oil. The Japanese obtained it from China and sold it to American consumers under the name which they applied to it.

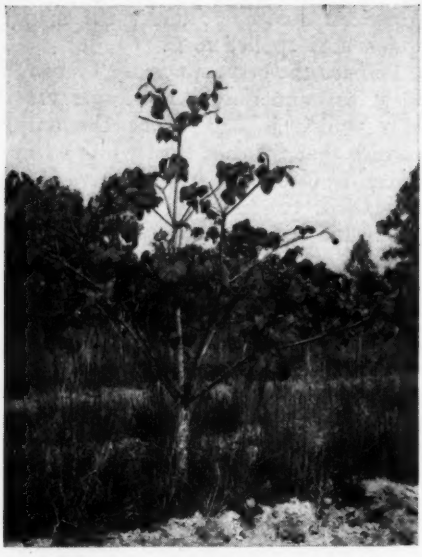
Perhaps the best known use of tung oil is in the manufacture of spar varnish, which is said to be the only varnish that will not turn white when water is placed in it. This varnish is made of tung oil and resin. South Mississippi, site of the greatest development of tung trees in America, grows both pine trees and tung oil. The two in many instances are growing side by side, bringing together two useful products that were produced on separate continents for many centuries.

New Projects

The largest tung oil project in the world is located near Picayune in Pearl River County. It embraces slightly less than 10,000 acres and is owned by Lamont Rowland, who is utilizing cut-over land in an extensive development. A tung oil mill is being built at Picayune for extracting the oil from the nuts now produced. There is another mill at



Four-year-old tung tree in blossom. Commercial fertilizer was applied at the rate of 4 lbs. per tree.



Unfertilized tung tree the same age and on the same soil as the one below.

Bogalusa, Louisiana, about 20 miles from the experiment station at Poplarville.

Tung trees, according to Dr. Robert, require a heavy rainfall—about 60 inches annually—and do not thrive where the temperature dips lower than 12 degrees. The rainfall and temperature of the lower third of Mississippi compare favorably with that of the tung tree section of China. The soil, he thinks, is excellent, although tung trees, like any other plant, are affected by the amount and kinds of plant food in the soil.

Very little has been done in an experimental way in Mississippi to determine the kind and the amount of plant food that should be added to secure maximum results in both quantity and quality. Dr. Robert adds, however, that "tung trees respond well to fertilizer, when needed, and the specific need for fertilizer would depend on the quality of the soil."

Some experimental data on the effects of commercial fertilizer in varying amounts on tung oil productions have been gathered from tests conducted by the Great Southern Lumber Company of Bogalusa, Louisiana, which has extensive plantings on average cut-over land. Superphosphate (18 per cent) used alone in varying amounts, muriate of potash used similarly, and a complete fertilizer were tested against a check plot of no fertilizer.

Yields on the six plots of 1 acre each were varied, showing a decided leaning to the use of fertilizer in the production of tung oil. The yield on the 1-acre plot that was treated with 100 pounds of 18 per cent superphosphate was 1,327.5 pounds of nuts as compared to 1,405.61 pounds from the acre receiving 200 pounds of the same fertilizer.

An application of 200 pounds of muriate of potash used alone gave a yield of 1,030 pounds of nuts per acre, and a combination of 200 pounds of 18 per cent superphosphate and 100 pounds of muriate of potash boosted the per acre yield to 1,617 pounds of nuts. A complete fertil-

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Tree fertilized with 100 lbs. of muriate of potash and 200 lbs. of superphosphate per acre.

Learn Your Soil's Limiting Factors

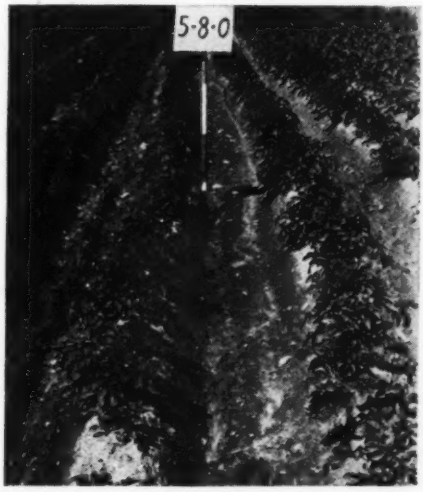
By Ford S. Prince
Agronomist, New Hampshire College of Agriculture, Durham, New Hampshire

THOSE of us who secured our college training two or three decades ago will remember the illustration of the barrel with a short stave with the water pouring freely out over this guilty member in a miniature Niagara. Perhaps the short stave was phosphorus, or again it may have been potash or nitrogen. It was probably one of these, but it might even have been organic matter or lime at that time. However, the picture did not portray boron, manganese, magnesium, or some of the other rarer elements as being the short stave causing the lack of water in the upper part of the barrel.

The point is, our thought with respect to fertilizer needs is constantly changing, in that there are being discovered new elements or substances that act as limiting factors, preventing optimum plant growth, often to the point of unprofitable production. Nor is this true only of newly-discovered materials, for it still holds true of the three "essential" elements as it always has.

We might venture to say that the leaching which normally occurs in humid climates is partially responsible for these changing conditions. Cropping, erosion, and any other source of loss of nutrients from the soil are doubtless contributing factors.

Take a specific illustration, such as the New England potato crop. Ten years ago the idea that this plant needed individual nutrients not found



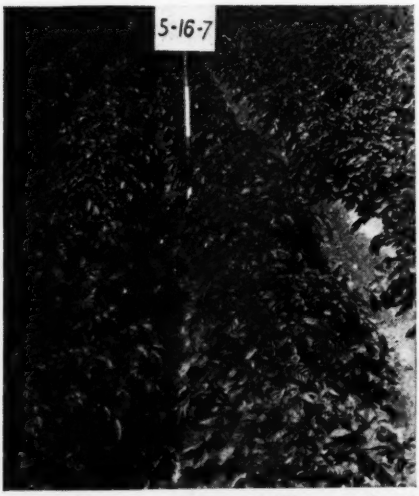
Potatoes grown without potash. Note scant foliage development.

in the ordinary fertilizer was unknown. Then came the discovery in Maine that a peculiar chlorosis, typified by a yellowish bronze color of the leaves, could be overcome by spraying the vines with soluble magnesium salts, and a new chapter in Maine potato history was written. Magnesium hunger typified by the chlorosis has now been overcome by putting the magnesium into the fertilizer, and the healthier crops that are produced respond to this treatment by digging out as many as 70 bushels more potatoes per acre, at an increased cost for the magnesium of only a dollar or so per acre. In this instance the inclusion of magnesium changed the yield as much perhaps as increasing

the amount of fertilizer 50 per cent or more.

This is but one of the limiting factors that may affect the New England potato crop. Leaching and cropping which have contrived to deplete the magnesium and calcium have caused a corresponding rise in the acidity of the soil. Land below pH 5.0 is common, and reactions as low as pH 4.0 to 4.5 are not unusual. At these acidity levels clover fails, bacterial activity is probably inhibited, and even the potato crop, one which is not highly sensitive to an acid soil, does not produce optimum crops. Extreme acidity which causes high solubility of iron and aluminum means that phosphorus and potash too are taken out of available form and cannot be secured by the plants. High fixation and low bacterial activity may easily mean a severe reduction in yield. The trouble may be overcome by liming, of course, but too much lime causes scab and farmers are a little chary about applying it.

According to principles laid down at the Maine Experiment Station and announced by Dr. J. A. Chucka, agronomist there, scab can be avoided and lime can be used if applied in small amounts in the potato rotation; not to exceed 1,000 pounds of ground limestone if the soil tests below pH 5.0, and not more than 500 pounds if the soil runs pH 5.0 to 5.3. Furthermore, any lime that is used should be applied after the potatoes are grown and before clover is sown so as to get the maximum benefit from the lime on the clover and to reduce scab-causing tendencies when potatoes are next planted. In New Hampshire lime in the above amounts at a soil reaction of pH 5.3 has not caused scab, but in amounts of 2 and 4 tons scabby potatoes have been produced no matter what the reaction of the soil.



Application of a 5-16-7 fertilizer produced these luxuriant potato vines.

Furnish Organic Matter

The proper use of lime under conditions such as have been described tends to overcome another limiting factor in potato production, and that is the lack of organic matter. Potatoes are not heavy users of plant food derived from this substance, although it is advantageous to supply them with nitrogen from the organic source. It is very advisable to have the soil well supplied with it though, to absorb and furnish moisture and overcome the effects of drought and midsummer heat which often seriously reduce yields. The utilization of a clover sod has given an average yield increase of 50 bushels per acre in our New Hampshire 300-Bushel Potato Club. This quickly-decaying organic residue means more nitrogen for the crop and more moisture during the growth period.

These points have been mentioned with respect to the New England potato crop to indicate that it is not always a lack of the plant-food elements, nitrogen, phosphorus, and potassium, that causes relatively low yield levels, although a grower must know his soils and their needs for these elements. Other factors are

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Present Trends in Fertilizer Usage

By R. E. Stephenson
Oregon State Agricultural College, Corvallis, Oregon

DURING the past 25 years fertilizer consumption in New England, the Middle Atlantic, and Southern States has not increased relatively as much as in other sections of the United States. The Southern States, by far the largest users, have dropped somewhat in total tonnage consumed, perhaps because of a reduced acreage of cultivated land. The midwest has materially increased its consumption, and the Western States now use more than three times the amount used 25 years ago. Fertilizer usage, like civilization, has followed the impelling urge to "go West." Total fertilizer consumption in the West is yet small, however.

Fertility Exhausted

Perhaps the explanation is simple. The soils of the West are relatively young in cultivation. Virgin fertility has carried production to the present time. But conditions are now changing. Recently a farmer of western Oregon stated that land which once produced 90 bushels of oats to the acre now produced about 30. Another stated that he knew a certain ridge country which had produced grain more or less continuously for the past 90 years, and still is producing something but not a very satisfactory yield. Another grain farmer asked what was wrong with his land which used to produce good grain but now produces very good straw which fails to fill. The grain yield is disappointing, perhaps due to exhaustion of available minerals of the soil.

Grain farming exhausts fertility and cannot be continued indefinitely without providing some means for humus renewal and the return of some of the mineral nutrients removed in the grain which is sold off the farm. In a few cases old, exhausted grain farms in western Oregon have been converted to nut orchards with not too much hope for success. Soil that is exhausted for grain is perhaps also too poor to grow trees that will develop into good bearing orchards. Certainly a soil-building program will be needed on such soils if orchards are to prove a success.

Soil depletion has moved westward and has preceded the adoption of good fertilizer practices. Speedy adoption of soil conservation and fertility maintenance practices may arrest the oncoming fertility depletion. Will we of the West stand by and see our great soil resources exhausted, or will we quickly adopt better practices to conserve our greatest natural resource? It is hoped that the latter course may be followed.

The first sign of waning fertility is often the depletion of the virgin humus. Yields drop somewhat in proportion as the active humus is depleted. This condition is associated with increased soil acidity, slow availability of the soil minerals, loss of soil structure, and failure of legumes. More than likely the growing of

legumes has long been neglected and that is part of the reason for the bad state of the soil. Too much plowing and too little sod favors erosion, and soon not only the fertility but the soil itself is gone.

Prevention usually is better than cure, and especially so in dealing with soil problems. Soil eroded away never can be recovered. Probably only natural soil generating processes can restore productivity to such areas, and this requires a long time. Meanwhile there is the economic loss from the depleted and eroded areas.

What to Use?

Legumes are unsurpassed for restoring humus and nitrogen to run-down soils. The importance of lime and fertilizers for growing legumes can not be contradicted. On fairly good soils deficient in available phosphorus, stands of alfalfa are sometimes maintained and yields doubled by annual top-dressings with superphosphate. Seriously depleted soils may become noticeably responsive to potash.

In the growth of plants potash concentrates in the forage. Animal manure, crop residues, and root systems make humus and help keep the active potash in circulation. When the humus is depleted by too continuous cultivation to row crops, or by removal of top soil through erosion, there is no means for keeping potash active. Such soils need complete and liberal fertilization to reestablish a plant cover.

The effect of potash and phosphate in bringing clover into grass sods has recently attracted attention. There is some speculation as to the cause. Potash is especially important to the manufacture of carbohydrate by plants. Legumes are perhaps compelled to manufacture more carbohydrate than non-legumes. The micro-organisms in the nodules of the legume must have carbohydrate (obtained from the host plant) to furnish energy for the fixation of atmospheric nitrogen. With insufficient carbohydrate the legume organism is unable to function efficiently. Thus potash becomes doubly important in the life processes of legumes.

This explanation of the importance of potash in starting legumes on poor land appears plausible. E. B. Fred of Wisconsin has demonstrated that the increased photosynthetic activity of legumes, brought about by increasing the carbon dioxide available to the leaf system, increases nitrogen fixation. Increased photosynthetic activity through the use of potash should have a similar effect.

The total tonnage of fertilizer consumed in the United States has increased during the past 25 years. The average composition or plant-food content of the fertilizer has also increased nearly 50 per cent. Nitrogen consumption for improving soils depleted of their humus has about doubled.

Maintain Productivity

Increased use of potash is especially noticeable during the period 1919 to 1929. In that period the use of muriate of potash increased sevenfold, while the use of manure salts with 20 to 30 per cent potash increased 22 times. Consumption of other forms of potash changed much less.

These changes in favor of higher grade materials and more liberal fertilization are the result of greater appreciation of the importance of commercial fertilizers in maintaining productive soils. Fertilizers are indirectly a help in erosion control. Fertilized pastures in Ohio had only one-eighth as much water run-off and a minute fraction of the erosion of unfertilized pasture. With crops grown in rotation at Missouri, the use of fertilizer

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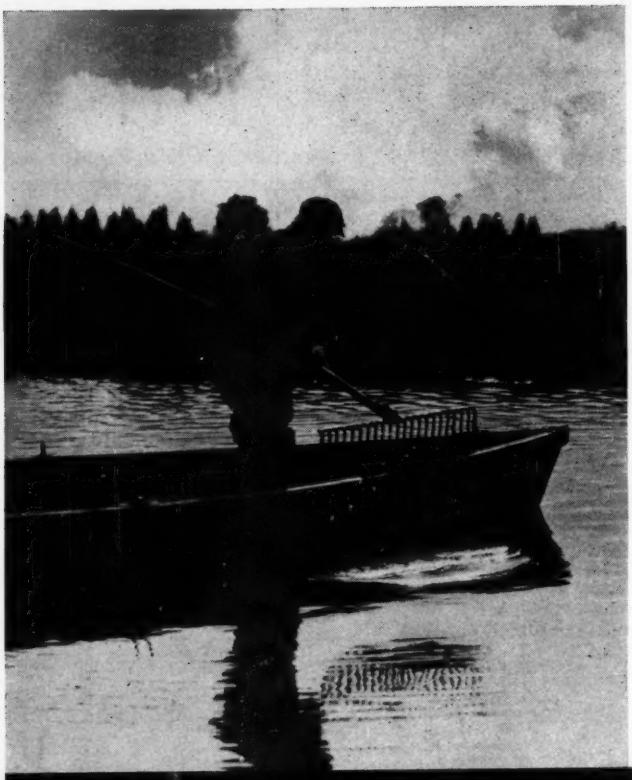
PICTORIAL

MIDWINTER MIRAGE.

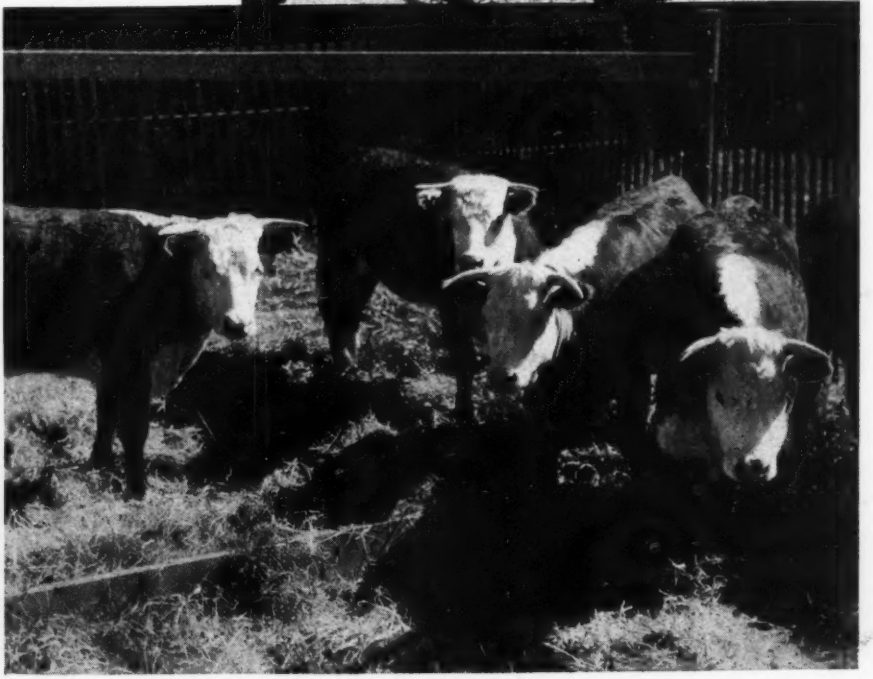


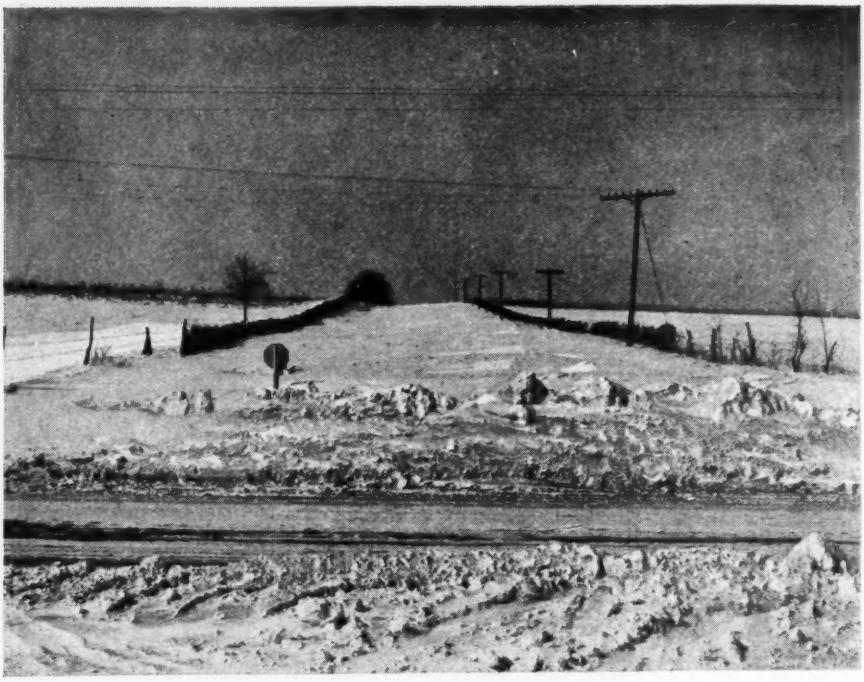
Left: A deep-water farmer at his harvest.

Below: "How many acres are you planting this spring?"

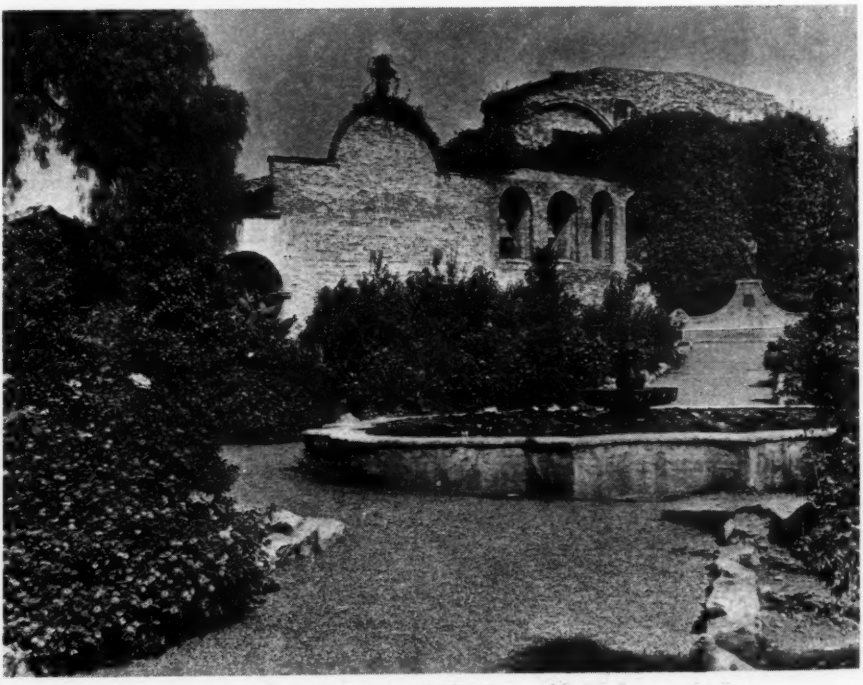
Right: "Farm gold" and good to the touch.

Below: Baby beeves with a tender, juicy future.





AT OPPOSITE ENDS OF THE ROAD.



The Editors Talk

The Size of an Acre

It has been said that the size of an acre depends upon the man who farms it. In other words, the yardstick of an acre is what it will produce, and what it will produce is governed by the man. With conservation a paramount issue in our current agricultural considerations, more and more attention is being turned to increasing the production of the acres in cultivation.

A recent press release from Purdue University carries the statement of Lynn Robertson, farm management specialist, that the average crop yields for Indiana have shown a distinct downward trend since the World War in contrast to an upward trend before the war. He cites this as just one of the indications that the productive capacity of Indiana farms is being rapidly reduced by soil erosion and depletion of fertility. Studies carried on in Indiana during the last two years point to the fact that land-use adjustments are needed in all parts of the state, but the amount of the adjustment and, to some extent, the nature of the adjustments needed vary from place to place.

With conservation programs calling for shifts of rough and unproductive lands into timber; easily eroded lands into pasture; decreasing inter-tilled or cultivated crops and increasing grasses and sod legumes; etc., acres in use are being called upon to produce the large yields and good quality of cash crops necessary to insure the farmer's income. That this involves and can be met with intelligent use of commercial fertilizer is attested by the years of research and experimental work at the various experiment stations.

There probably has never been in this country a greater need for the results of this work than at the present time. Agricultural extension workers who know how to increase the size of an acre are in demand and are rendering an invaluable service not only to the immediate welfare of the farmers but to the stability and preservation of our greatest national resource—the soil—for future generations.

Marketing Plant Food

"The farmer is only a marketer of plant food," is the oft'-quoted statement of Professor T. B. Hutcheson, head of the agronomy department, Virginia Polytechnic Institute. It does not matter whether you are a dairy farmer, cattle farmer, truck farmer or any other type of farmer, all that can be sold from the soil or farm is plant food. Perhaps you are marketing milk on a near-by city market. You use hay, grain, etc. to

feed these cows to produce the milk; but going back a little further plant foods, such as phosphorus and many other elements, are required to produce the feed. If you are a truck farmer you sell plant food through your truck crops. Nitrogen, phosphorus, potash, and many other plant foods that are removed must be replenished through fertilizers, manure, and crop residues. If this plant food is not returned, then the soil is rapidly depleted of these essential nutrients and profitable yields decrease.

An interesting example of the depletion of plant food is found on many pastures. For many years no fertilizer was needed to produce profitable pasturage. Today plant food must be added, for most of it has been marketed through cattle. A 1,000-pound animal carries the equivalent of a 100-pound bag of 16 per cent superphosphate in its bones. A dairy cow giving 20 pounds of milk per day will take out of the soil in one season the equivalent of 15 to 20 pounds of nitrogen, 45 to 50 pounds of phosphoric acid, and 45 to 50 pounds of potash. This depletion of plant food brings about a change in the vegetation of the pasture: broom sedge replaces the Kentucky blue grass.—*Virginia Polytechnic Institute, Extension Division News, Vol. XVIII, No. 7, May,* 1936.

County Councils

A very worth while cooperative project has been recently reported in Extension Service Review, U. S. Department of Agriculture. County Councils in 44 of Florida's 67 counties were organized late in 1935. The membership of these councils includes the county agent as chairman of a group of successful farmers and leading farm women, the home demonstration agent, vocational agriculture teachers, representatives of civic clubs, and others interested in and familiar with the county's agriculture. The Federal Extension Service has supplied the councils with available agricultural data pertinent to the respective counties and has aided in the division of the State of Florida into 13 different areas by type of farming.

As noted, "Florida is a land of diverse soils, and a knowledge of the soil types in the county is necessary before intelligent recommendations can be made as to the use of this land for the production of crops or for timber, pasturage, or other purposes." All soil survey information available is being assembled by the Extension Service for the use of the councils. The councils serve as a medium for obtaining farmer approval of plans proposed by the State and Federal officials and for submitting pertinent suggestions for county, State, and National agricultural programs. They permit quick contact with a group of important farmers in each county for discussion of specific problems. They also enable farmers of each county to meet voluntarily to discuss their production and marketing problems.

These county councils, particularly in states where there are no farm bureaus, National Grange, or similar farm organizations, would seem a great step toward planning for a more profitable local agriculture. In a short space of six months they proved their usefulness in Florida, and it is to be hoped that their inauguration will find favor in other sections of the country.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

Much information pertaining to the importance of potash on Vermont pasture soils and ways that it may be used most economically are contained in Vermont Agricultural Experiment Station Bulletin 403, entitled "Need and Use of Potash on Vermont Pastures," by A. R. Midgley and V. L. Weiser. The publication presents the results of several plant-food combinations that were used on pastures from 1931 to 1935 in order to determine the effects on the nature and composition of the herbage. A large part of these studies involved chemical soil tests, plant response in greenhouse, field plot tests on the major soil types, and determinations of potash fixation and crop growth with different rates of application.

Most Vermont soils, particularly pasture soils, are likely to be somewhat deficient in potash and crops growing thereon respond well to potash applications. This is especially the case where clover is predominant. Clover, being a desirable plant which readily responds to mineral fertilization, is likely to increase in growth with each additional amount of potash. Increased yields of white clover when three times the usual rate of minerals is applied indicate the high mineral requirement of this plant. Maximum yields of grasses usually result from applications of 75 to 100 pounds muriate of potash per acre. Chemical soil and plant tests indicate Champlain Valley soils contain enough potash for some crops, although pastures on these heavy soils sometime respond to added potash.

The increases obtained in pasture field tests were significant when potash and superphosphate were applied to the soils studied. In these tests the pasture mixture included timothy, red top, Kentucky bluegrass, alsike, red and white Dutch clovers. Liming proved advisable in practically all cases, and substantially increased yields were obtained from nitrogen applications.

Other subjects discussed are the potash fixation properties of a number of important Vermont soils, the importance of close grazing, and selection and establishment of desirable strains of pasture plants. Several excellent illustrations portraying the responses of different pasture fertilization appear in this interesting bulletin.

"Influence of Commercial Fertilizers on Yields, Grades, and Net Value of Potatoes in Hood River Valley, Oregon," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 343, June 1936, Gordon G. Brown.

Soils

The unprecedented activities of the Soil Conservation Service, U. S. D. A., during the past year are revealed by H. H. Bennett in his "Report of the Chief of the Soil Conservation Service, 1936." It is significant to note the advance this Service has realized toward better husbandry of our national soil and water resources. Federal State, and private enterprises began for the first time to move in unison through several avenues of action toward wiser use of the land in a basic

pattern for permanent cooperative effort in the field of soil conservation. The report states that landowners and operators throughout the country took full advantage of new opportunities to protect and preserve their lands, which indicates that a brighter future for coming generations is in the making through this concerted action. The vast responsibilities confronting these agencies and every landowner and agricultural worker to protect and preserve our natural resources, maintain navigable rivers and harbors, and a great many related problems cannot be minimized. A broad conception of these functions underlying the purposes of the Soil Conservation Service is the theme of Chief Bennett's Report. It is full of educational information that should prove very valuable to many who are interested in securing a wider knowledge of what the conservation movements mean to this great Nation.

Methods of establishing a successful field of alfalfa under Missouri conditions are clearly outlined in Missouri Extension Service Circular 354, "Soil Treatment for Alfalfa," by O. T. Coleman. Usually little trouble and expense are experienced where alfalfa is grown on some of the fertile, well-drained river and creek bottoms that do not overflow frequently. According to this publication, most upland soils of the state are too deficient in lime, phosphorus, and often available potash, to grow alfalfa successfully. It will make favorable growth, however, when such soils are well suppied with these elements, provided they have fairly open subsoils, are well drained, and the proper seeding practices followed. Liberal amounts of lime, phosphorus, and potash must be supplied where the soil is low in these necessary nutrients. If the soil is somewhat light in color and has not received manure or no green manure crop turned under in 3 or 4 years, the use of complete fertilizers as 4-12-4 or 4-16-4 is recommended. Where the land has been heavily cropped to grain preceding alfalfa or if the land has grown alfalfa for several years, an 0-14-6 or 0-14-7 usually produces satisfactory returns. Proper inoculation for alfalfa is important and methods for this procedure are given. When once a good stand of alfalfa is obtained the author states this crop should not be plowed up for at least 4 or 5 years.

"The Hydrolysis of Calcium Carbonate and Its Relation to the Alkalinity of Calcareous Soils," Agr. Exp. Sta., Tucson, Ariz., Tech. Bul. 64, Oct. 15, 1936, T. F. Buehrer and J. A. Williams.

"Soil Management Systems in a Young Bartlett Pear Orchard," Agr. Exp. Sta., Wooster, Ohio, Bul. 578, Dec. 1936, Freeman S. Howlett.

"The Comparative Moisture-Absorbing and Moisture-Retaining Capacities of Peat and Soil Mixtures," U. S. D. A., Washington, D. C., Tech. Bul. 532, Sept. 1936, I. C. Feustel and H. G. Byers.

"What Kind of Agricultural Policy Is Necessary to Save Our Soil?," U. S. D. A., Washington, D. C., Bul. DS-7.

Crops

According to E. Y. Floyd in North Carolina Extension Circular 212, "Factors Affecting the Quality of Flue-Cured Tobacco," the fertilizer used in the production of bright flue-cured tobacco is very important. In a rotation preceded by corn or cotton the average tobacco should receive an application of 800 to 1,000 pounds of 3-8-5 tobacco fertilizer per acre. On some soils 8 per cent potash is required. In all cases the chlorine content should not exceed 2 per cent. Sources of potash should be from muriate, sulphate or sulphate of potash-magnesia, and the phosphate from superphosphate. One-fourth nitrate nitrogen, one-fourth ammonium nitrogen, and one-half organic nitrogen should be the sources of nitrogen. It is recommended that 1 to 2 per cent magnesium oxide should be contained in the fertilizer. While there are a number of minor nutrients which are

essential, these are carried in the materials mentioned above.

In addition to the fertilizer requirements so necessary for producing good quality tobacco there are many other factors to consider, such as proper cultural practices. The selection of favorable varieties, correct handling of the seed bed, preparation of the field, transplanting, and cultivating are described. Among the other necessary practices for successful tobacco production detailed in the circular are control of insects, topping and suckering, harvesting, curing, and tobacco grading.

"Growing Seedlings in Sand," Agr. Exp. Sta., New Haven, Conn., Cir. 117, *Dec.* 1936, *A. A. Dunlap.*

"Annual Report of the Extension Service in Agriculture and Home Economics," Agr. Ext. Serv., Newark, Del., Bul. 24, *Apr.* 1936, *C. A. McCue, Director.*

"Alfalfa in Georgia," Agr. Ext. Serv., Athens, Ga., Cir. 264, *Sept.* 1936, *E. D. Alexander and Dr. John R. Fain.*

"Triennial Report of Agricultural Extension Work in Louisiana—1932-'33-'34," Agr. Ext. Serv., Baton Rouge, La., J. W. Bateman, Director.

"The Well-Gardened Home," Agr. Ext. Serv., Baton Rouge, La., Vol. I, No. 15, *"Fall Flowers for Louisiana," and Vol. II, No.* 2, *"General Orchard Management," June* 1936, *Bertha Lee Ferguson.*

"Permanent Pastures for Cattle Production in the Rice Area of Southwestern Louisiana," Agr. Exp. Sta., Baton Rouge, La., Bul. 276, *Oct.* 1936, *J. Mitchell Jenkins.*

"Effect of Date of Seeding on the Length of the Growing Period of Rice," Agr. Exp. Sta., Baton Rouge, La., Bul. 277, *Oct.* 1936, *J. Mitchell Jenkins.*

"Factors Affecting the Cooking Qualities of Potatoes," Agr. Exp. Sta., Orono, Me., Bul. 383, *July* 1936, *Marion Deyoe Sweetman.*

"Agricultural Experiment Station Report for Two Years Ended June 30, 1936," *Mich. St. Col., East Lansing, Mich., V. R. Gardner, Director.*

"Pruning and Care of Ornamental Trees and Shrubs," Agr. Ext. Serv., East Lansing, Mich., Bul. 172, *Nov.* 1936, *O. I. Gregg.*

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 19, *No.* 2, *Nov.* 1936.

"Sagrain in the Yazoo-Mississippi Delta," Agr. Exp. Sta., State College, Miss., Bul. 314, *Aug.* 1936, *Roy Kuykendall.*

"Work of the Agricultural Experiment Station," Agr. Exp. Sta., Columbia, Mo., Bul. 370, *Nov.* 1936, *F. B. Mumford and S. B. Shirky.*

"Fruit Varieties for Missouri," Agr. Exp. Sta., Columbia, Mo., Bul. 371, *Dec.* 1936, *T. J. Talbert.*

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Economics

It is of interest to note the broad scope and the many functions of the Bureau of Agricultural Economics, U. S. Department of Agriculture, as outlined by A. G. Black, Chief of the Bureau, in his report to Secretary Wallace

covering the fiscal year ending June 30, 1936. According to the report, the drought was the outstanding physical fact in American agriculture, and the improvement in farm prices and income was the outstanding economic fact. The social cost of the drought will be very great. It has reduced drastically and even wiped out the very limited resources of many farmers who, except for the prompt assistance provided by government action, would have fared far worse. Mr. Black believes that this drought has emphasized the need for measures that will contribute to the security and stability of farm income.

In spite of the severe drought, agricultural income has increased considerably as compared to last year, and the outlook for agriculture next year is favorable. Supplies in most lines of production are no longer excessive. However, it is further pointed out that it is necessary that the outlook for agriculture be not judged in terms of a single year since there are fundamental weaknesses in the position of agriculture that will require vigilance and action. The nation's capacity to produce agricultural products is far in excess of the existing market demand even allowing for considerable expansion in domestic requirements. Increases in foreign markets are taking place very slowly, and domestic demand cannot be expected to advance to a point that will assure an ample market with satisfactory prices for all American farmers can produce.

How to dispose of surpluses that we have reason to expect in future years with return of normal weather in the face of greatly reduced foreign demand for farm products is a problem the nation must be prepared to meet. A most serious factor, of course, continues to be the bars that have been erected by practically all nations against the international exchange of goods. While some inroads have been made on this problem, the need still continues for emphasis on the fundamental problem of disposing of farm surpluses through normal trade processes.

It is indicated that the Soil Conservation Program may be one solution to the agricultural problem. There is a need for increasing the emphasis on the program of the proper land use and upon soil and water conservation and unless steps are taken to check the great waste resulting from soil erosion, the unit cost of food must inevitably rise steadily. In this connection the possibility of maintaining a steady farm income by storing products in years of overproduction to be used in years of shortages is believed to be a sound plan. However, farmers should be compensated for contributing to an adequate and continued supply of farm products by being given a more secure income. Crop insurance and the principle of the ever-normal granary have been advanced as possible ways to produce this result, and the Bureau in addition to many other activities is now in the process of investigating the field of crop insurance in an effort to develop principles for a program of action.

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Ingenuity In Irrigation

Realizing the need of moisture at critical periods in crop growth, farmers, especially fruit and vegetable producers, have invented many ingenious devices for irrigating small plots for intensive cultivation, says F. E. Staebner, of the Bureau of Agricultural Engineering.

Old auto engines provide the power in most instances. Old pipes, used lumber, and second-hand odds and ends have been utilized to build inexpensive watering devices on land not level enough for ditch irrigation.

Supplemental irrigation has been recognized as an asset even in the more humid areas of the eastern United States, Staebner declared. Practically all of the farmers report material benefits from being able to water their crops when they need moisture most.

U. S. Grows Most Apples

The United States is the largest producer and exporter of apples in the world, according to the Bureau of Agricultural Economics. On an average, during the five years, 1931-35, approximately 31 per cent of the world apple production of 500 million bushels was produced in the United States.

Of the average of 155 million bushels of apples produced in that five-year period in the United States, the Bureau reports approximately 84 million bushels (54 per cent) were consumed as fresh fruit, about 6 million bushels (4 per cent) were canned, roughly 3 million bushels (2 per cent) were used for making brandy, about 7 million bushels (4.5 per cent) were dried and evaporated, and about 55 million bushels (35.5 per cent) were used for other apple products (including vinegar and cider), used on the farm, fed to stock, or left unharvested.

There are a total of roughly 450 million apple trees in the world, one-fourth of which are in the United States.

Farmers' Returns Higher

Ottawa, Canada.—One of the most encouraging features of the recovery witnessed in Canada during 1936 was the narrowing of the spread between prices of farm produce and prices of the things the farmers buy. At the low point of the depression in 1932, it is estimated that farmers were receiving only 35 per cent of the 1926 level of prices for their produce, while prices of things farmers buy had fallen only to 82 per cent of the 1926 average. By the end of 1936, farm prices had risen to 65 per cent of the 1926 level, while prices for goods purchased by the farmers have not yet risen above 1932 levels.

The market for Canadian farm produce at home depends to a very large extent on the activity in other industries. Material recovery was recorded by most of these industries during 1936. Preliminary estimates show that the average level of production in 1936 was at least 8 per cent above 1935. The manufacturing industries showed an improvement of 11 per cent for the first ten months of 1936, while newsprint production and the output of electrical power reached new all-time high levels. Construction has lagged behind other industries, but the increase in private building rather than public enterprise is an encouraging sign. Employment has shown a material advancement in the numbers actually employed.

A 4 per cent rise in retail sales and increases in merchandise car loadings indicates that consumption during 1936 was higher than in 1935. The income received by farmers was above that of the preceding year, and indications are that for the first six months of 1937 a further increase will be recorded.

Meet Indiana's 1936 Onion King

(*From page* 15)

does Andy know that acts like a magnetic force in piling onions high on his crop acres?

Andy's 1936 onion crop comprised 40 acres, and the nation's record-breaking acre that produced the 1,471.98 bushels of U. S. No. 1 onions was situated in one of his 7-acre fields.

There is no doubt about how Andy feels regarding the use of commercial fertilizers. A peep at the crop history of this 7-acre field would be evidence enough. In 1933, following a 200-pound per acre application of 2-8-16 fertilizer, 25 pounds of mint oil per acre were obtained. Then, the following year, 35 pounds of oil per acre were produced, and 200 pounds of 3-9-18 fertilizer were applied on each acre. In 1935, onions were planted that produced only an average yield. That year 700 pounds of 2-8-16 fertilizer were used on each acre.

This year, Andy applied 500 pounds of 0-20-20 fertilizer broadcast and then used 300 pounds of 2-8-16 under the row. His muck soil, which has a reaction of pH 5.7 (medium acid), was plowed on April 2 to a depth of 12 inches, and later it was double disked and dragged. On April 21 "King Andy" seeded his onions, placing the seed in the soil with about an inch of covering, with the fertilizer

that was being put into the row drilled under the seed about 2 inches deep. The growing crop was wheelhoed five times and hand-weeded three times. By September 7 the onions were ready to take out of the soil. They were harvested within the next 4 days.

The seed used to produce the record onion yield was imported from Denia, Spain, and is of the Sweet Spanish variety. Andy says that right now he can't get any more seed from Spain, because of the revolution in that country. However, he has some left from last year. Last spring he sowed 3¼ pounds of seed per acre.

Andy has other ideas about onions besides producing high yields. For instance, he says:

"The onion is a member of the lily family. If we develop it properly, we can invade the floral markets and grow flowers and food from the same bulbs. In the future, people will be wearing onions as well as eating them."

In regard to what the "King" is planning for his muck farm, he says: "We are diversifying our farming business now, planting equal acreages to onions, mint, and potatoes. It is my belief that farming as a business in the next few years is going to pay handsome dividends, provided, however, a farmer keeps up with research, modern equipment, and is not too smart to be taught new methods. The value of fertilizer in an onion crop cannot be overestimated."

Present Trends in Fertilizer Usage

(*From page* 22)

reduced erosion from one-half to one-fifth of that occurring on unfertilized soil.

The soil conservation program attracting national recognition at the present time is based primarily upon a farming system that will maintain a more effective plant cover, through crop rotation with grass and legumes to form dense sods that hold the soil. An improved stand of grass in the Great Plains that increased the protection from 16 per cent to a 40 per cent cover, cut down erosion more than half. The conservation of water is dependent upon getting more of the rainfall into the soil and holding it there for crop growth. Humus and plant roots about control water penetration into the soil. In Missouri, old soils depleted of their humus held only half the water of virgin soils rich in humus and retentive of moisture.

Fertilizers have an important place in bringing back grass and legumes to our fields. Fertilizers make vigorous plants and deep root systems that enrich the soil. With abundance of vegetative growth dense sods and branching roots there is little cause to worry about loss of either the soil or its moisture, except as the water is used by growing plants.

In highly developed areas the use of fertilizers is already well established. A county agent from an Oregon county with city markets recently stated that vegetable and small fruit growers in his territory used 1,000 pounds to a ton of high-grade complete fertilizer to the acre. In some cases as much as 1½ tons to the acre were used.

These successful growers in a specialized industry have taught the farming public much about possibilities in the use of fertilizers. The importance of liberal and complete

fertilization to bring high yields and superb quality has been particularly evident. Nitrogen produces a tender succulence, much sought after in some crops, but with it a high susceptibility to disease. Potash plays an important part in increasing resistance to fungus diseases. Phosphorus produces roots and seed, while potash favors production of sugar and starch. These various functions of the plant nutrients are given consideration by the vegetable grower. Other things than the standard N-P-K sometimes need attention. An investigator recently stated "Every plant must have a complete and adequate supply of nutrients for maximum growth. What the soil does not furnish the grower must supply with fertilizers."

Controlling Factors

Future crop yields in a given locality depend upon adequate evaluation of three important controllable yield factors; (1) tillage including proper seed-bed preparation and planting, and weed control after planting, (2) crop rotation which introduces a sufficient number of sod crops to hold the soil and renew the humus, (3) fertilization and liming to grow desirable types of crops and obtain yields that are profitable. W. W. Weir states that it took 3,000 years to learn the significance of crop rotation, and perchance we have not all learned yet. The fertilizer industry is about 85 years old. Let us hope that much less than 3,000 years will be needed to develop an adequate system of soil fertilization. Present signs indicate that considerable progress has already been made and that more is in the making.

During the past 10 years marked progress has been made toward more effective placement of fertilizers with reference to the seed. More adequate fertilizer distributing machinery recently developed has perhaps doubled returns obtained through fertilization. With all our progress there is yet much to learn and even more to do in the way of practicing the best we know. Our attitude in this respect at present is more favorable than it has been before. Farmers and growers when met in conferences seem anxious to obtain the latest information on soil problems. They want to know how to conserve fertility and to increase yields through economic fertilization.

Mineral Fertilizers for Pasture Improvement

(*From page* 8)

had been stimulated by the use of minerals on soil previously limed, to such an extent that it produced more nitrogen for growth than sulfate of ammonia at the rate of 150 pounds per acre.

This 2-year greenhouse test substantiated field experiments, indicating that superphosphate applied alone or simultaneously with lime, on soils of high phosphate-fixing power, is not fully effective in stimulating plant growth. Since available phosphorus is generally low on pasture soils, the addition of potash is not stimulating until the supply of available phosphorus has first been increased. Lime applied well in advance of other mineral treatments has a beneficial effect on the availability of phosphate fertilizers on certain depleted soils.

In March of 1936, tests of lime and fertilizer treatments were established on 24 typical permanent pastures in New Jersey, to survey the type of response which might be ex-

pected from various fertilizers on a wide range of soils. Although it will require a longer period to fully demonstrate the principle indicated by the controlled greenhouse experiments, the field results of the first year are rather convincing. Immediate favorable response to simultaneous applications of lime, phosphate, and potash was observed only on soils with relatively mild acidity and high content of available bases, particularly calcium and magnesium. Such types as Dover loam, Washington loam, and Chester gravelly loam showed favorable response, but none of the red soils of the Piedmont formation, the Coastal Plain soils, or the acid soils of the Appalachian highlands showed marked improvement during the first season after spring treatment. Lime alone was applied to plots in all 24 pastures in 1936, and mineral treatments are to follow in 1937.

It is obvious that indiscriminate use of mineral fertilizers may be disappointing, particularly on many depleted soil types, even though soil tests indicate a serious shortage of mineral nutrients. It has been shown that a full season is required for lime to penetrate pasture sod and appreciably change the soil to a depth of 1 inch. Apparently it would be a safer procedure to lime well in advance of other soil treatments rather than apply lime and mineral fertilizer together, unless the soil type is one which is known to respond satisfactorily to simultaneous applications.

Analyses for available soil nutrients were made on each of the 24 test pastures in New Jersey, with interesting results. In general, the supply of available phosphorus was quite deficient, and in many cases the calcium and magnesium supplies were quite low in spite of acidity values that were only mild to moderate. The situation on 24 permanent pastures was as follows.

It is clear that the supply of available minerals is inadequate on the majority of these permanent pastures which have not received treatments in recent years. The most impressive feature of these tests was the fact that every pasture was deficient in at least one of these essential nutrients, and some were deficient in all four.

Supply of Available Nutrients	Number of Pastures Observed			
	Potash	Phosphate	Calcium	Magnesium
Medium to high	6	0	4	2
Below medium to low	14	3	11	9
Very low to trace	4	21	9	13
Total pastures	24	24	24	24

The Urgent Problem

The immediate problem in pasture improvement is to find the most economic way of raising the supply of the essential soil nutrients to a higher level. The rewards are great for using treatments which actually increase the availability of the mineral nutrients. Perhaps the best index as to the degree of success obtained in such treatments is the increase in abundance of legumes, particularly white clover. In the field experiments cited earlier in this report, the total nitrogen content of the herbage on the lime-phosphate-potash plots for the year was 123.9 pounds per acre in contrast to 47.5 pounds on the untreated plots, a difference of 76.4 pounds. Assuming a normal efficiency of 40 per cent in utilization of nitrogenous fertilizers by crops, it would have required 830 pounds of sulfate of ammonia to produce a similar improvement in protein yields of pasture herbage, without the aid of clover. Such tremendous yields of

nitrogen (or protein) will be provided by clover without cost, where conditions are made suitable for this species. Moreover, nitrogen fertilizer cannot completely take the place of clover, since the legume is deeper rooted than grasses and thus is able to make more growth during the critical dry months of July and August.

Nitrogen fertilizers undoubtedly are of predominant importance in pasture improvement. The question is primarily whether the nitrogen may best be supplied by encouraging growth of a legume, or by application of commercial fertilizer. The immediate response obtained by applying sulfate of ammonia, nitrate of soda, and other soluble nitrogen compounds makes them an attractive treatment to recommend to farmers, even though such applications may not be the most valuable in the long run. Aside from this point, nitrogen fertilizers do have a definite place in pasture management, whenever the problem of stimulating legumes has not been solved. The use of nitrogen fertilizer, however, actually increases the need for minerals, since greater growth of herbage means more rapid exhaustion of soil minerals.

As a matter of fact, the most efficient use of nitrogen may be made only when the current supply of mineral elements is adequate. Striking evidence on this point is provided by the following comparisons made on 3 permanent pastures in 1936.

The available soil phosphorus was quite low, the pH values were 5.8 to 6.0, and the calcium content medium to high on these 3 soils. The low yield on the Penn loam soil was partly due to the severe drought which affected the region in which this test was located. The treatments were made in late March, with the fertilizers broadcast all on the same day. The nitrogen was derived equally from nitrate and ammonia fertilizers. Since much of the seasonal growth on the nitrogen plots occurred within 2 months after treatment, the beneficial effects of the minerals must have been due largely to the potash supplied. Neither the lime or phosphate could have penetrated sufficiently in that period to be of great value.

It is of course not a new principle that potash is essential for efficient utilization of large amounts of nitrogen. However, it has frequently been assumed that there is a sufficient reserve of minerals in the soil to provide grass with all the nutrients it may need for at least a year or two under heavy nitrogen feeding. In these experiments, nitrogen fertilizers alone did increase yields substantially over the untreated plots, but the addition of the mineral treatment more than doubled the response to the same amount of nitrogen on those soils not rich in potash. Apparently, the supply of available potash in pasture soils must be relatively high to provide full response to liberal dosages of nitrogen fertilizers. The returns per unit of nitrogen will doubtless be even

Soil Type	Available potash in Soil	Yearly Yields of Dried Clippings		
		Nitrogen Fertilizer Alone (60 Lbs. N. per A.)	Nitrogen Fertilizer Plus Lime and Minerals	Per Cent Increase
		Lbs.	Lbs.	
Penn loam (shallow phase)	Medium	1,160	1,847	59.2
Bermudian silt loam	Medium plus	2,620	3,446	31.5
Sassafras loam	High	2,857	3,119	9.2

greater where the available phosphate and calcium supplies are also high.

Successful improvement of pastures involves factors other than proper soil treatment, critical as this may be. The elimination of shrubs, trees, and other non-productive vegetation must precede liming and fertilization, in order to facilitate the use of broadcasting machines and permit maximum plant response. On many pastures the superior forage species are not present because of low soil fertility, and must be introduced to fully utilize the soil resources after these have been restored to a favorable level. In addition, the plant growth produced must be utilized by efficient grazing practices, or the value will be lost. It has not only become evident by experiments in several states of this region that proper soil treatment does pay handsomely on pastures, but that a study of each soil type and pasture will be well worth while to determine the most effective way of improving soil fertility to support productive and nutritious types of pasture herbage.

Learn Your Soil's Limiting Factors

(*From page* 20)

constantly cropping up, like magnesium in various parts of New England, to work havoc with plant growth and yield unless the symptoms are recognized and overcome with proper treatment.

Many of these special conditions have already been recognized and remedied in a broad general way, such as the application of sulphur on soils of the Pacific northwest. It is quite possible that the humid northeast region would be suffering from a sulphur deficiency were it not for the fact that fertilizers carrying sulphates, such as the ammonium sulphate and calcium sulphate in the superphosphate, have been constantly applied.

The use of copper on the Florida Everglade soils is another case in point. According to Superintendent Daane of the Belle Glade Substation, before cropping is in any wise successful, an application of copper sulphate must be applied to this type of soil. Once this is made, response is secured from potash and phosphorus, but until copper is applied there is little use to fertilize with anything, so serious is copper deficiency.

This appears to indicate a very delicate balance of soil nutrients for correct plant growth. Unless this balance is maintained, yield results are unsatisfactory and the growth is often accompanied by symptoms of malnutrition either on the foliage or in the roots, fruit, or in the quality of the crop produced.

All this discussion about boron is pertinent in this connection. So many instances of nutritional difficulties with cabbage, cauliflower, turnips, and other crops have been noted and traced to boron deficiency that there can be little doubt that boron is the guilty member of the plant-food group. However, a couple of decades ago this element was considered merely an accidental one in plants, absorbed by plant roots merely because it was in solution in the soil, but not utilized in plant nutrition.

It is, of course, unfortunate that boron in large quantities is toxic to plants. This fact, apparently indisputable, has tended to obscure the beneficial effects of the substance when applied in limited quantities. So many favorable effects have now been reported for its use that a new avenue of research has been opened up involving the limits of tolerance, the losses that occur to the element by leaching,

Lack of phosphorus resulted in stunted potato vines.

its effect on a whole range of crops in regions where it has been found to be deficient, and particularly, accurate soil tests for the availability of the substance, if any is present in the soil, to the extent that it may be predicted with more or less accuracy whether its application is necessary for optimum plant growth. Furthermore, a whole range of crops must be examined to ascertain whether boron need for one crop is greater than that for another in regions where the element is found to be deficient.

It would be ideal if all crops were like tobacco and would show by characteristic growth habits which element is lacking as a nutrient deficiency, so that the lack could be directly met. Most of them probably do to a greater or less degree, and it remains for these symptoms to be diagnosed for proper remedy. Even if these symptoms are patent to the trained investigator, they are still mostly beyond the ken of the farmer, and in his mind any difficulty that crops up is more likely to be diagnosed in the light of his information as disease symptoms rather than those of malnutrition.

A good many of the soils of the northeast region are on a rather delicate balance with respect to nutrient elements, as well as with soil acidity. In some cases acidity is at the point where the application of an acid fertilizer will depress the yield when compared with one which has had enough limestone added to neutralize the acids developed by the fertilizer itself.

Another point of particular interest to potato men with respect to neutral or basic fertilizers is that these are applied with the planter in narrow bands, and the acid-forming elements may leach out and not be neutralized by the lime that has been added, which would tend to leave zones of soil in which there would be enough lime to promote potato scab.

Copper is not likely to be a limiting factor on potato farms. On other farms where bordeaux sprays are not applied this element may cause plant disturbances, although its lack is probably more pronounced on organic soils, such as the mucks and peats sometimes used for vegetables and special crops. The same is true of manganese, but this element is often thrown out of availability by overliming operations, and it may be necessary to remedy the difficulty by applying manganese in a form suitable for fertilizer use.

Constant Deterioration

No one is ready yet to state that boron and these other elements should be mixed into all the fertilizers in the northeast. The extent to which the soils have suffered by leaching, by crop removal, by the sale of livestock and its products, and by other means through which fertility is lost is yet to be ascertained. Certain it is that leaching and cropping, pasturing, etc., still go on, taking their toll of valuable and limiting elements that sooner or later must have attention by farmers and fertilizer manufacturers. This whole question of acid-forming

fertilizers needs study and experimenting with to determine whether their neutralization is necessary and in all cases desirable.

The pioneer age in land settlement in the United States is now a matter of history. More and more the fact is impressed upon us that we must use the soil we have and discover its needs for profitable crop production. Its use in the future is bound to take us back into the pioneering age, for the processes of soil deterioration are constantly present in one form or another tending toward the depletion of precious stores of this element or that, any one of which may be fundamental, not only for plant, but likewise for animal and human nutrition.

These problems even now engage the attention of scientists and farmers in an absorbing struggle. They involve the fertilizer manufacturer to an even greater degree than ever before. An even pace must be kept with the destructive forces if all is to go well. Whatever occurs, the struggle is bound to be interesting.

Potash for Cotton in the Delta Foothills

(*From page* 10)

this average increase due to potash amounts to $14.24 per acre. Mr. Atkinson says the first year's results with potash have been worth $10,000 to him on his plantation.

Potash increased the yield 232 and 310 pounds per acre respectively for 1935 and 1936 at the Schaeffer field. The 2-year average increase for potash at the Schaeffer field is 271 pounds of seed cotton per acre over the yield with nitrogen alone. Valuing seed cotton at 4c per pound, this average increase due to potash amounts to $10.84 per acre.

The average increase due to potash in all fields in 1936 amounts to 174 pounds of seed cotton per acre over

RESULTS OF ELIMINATION FERTILIZER TESTS ON COTTON

	Pounds of Seed Cotton Per Acre						
	Delta Foothills Proper			Coldwater-Tallahatchie-Yazoo River Basin			
Treatment	Atkinson field	Hemphill field	Ladd field	Smith field	Schaeffer field	Gary field	Av. all fields
		1935			1935		
N	728	734			1,813	1,290	1,141
NP	844	756			1,964	1,388	1,238
NPK	1,112	909			2,048	1,401	1,368
NK	993	815			2,045	1,342	1,299
		1936			1936		
N	1,077	1,442	1,317	1,339	1,459	1,106	1,290
NP	1,074	1,491	1,342	1,384	1,811	1,121	1,371
NPK	1,504	1,501	1,713	1,347	1,848	1,179	1,515
NK	1,524	1,394	1,583	1,389	1,769	1,122	1,464
	Average 1935-1936			Average 1935-1936			
N	903	1,088			1,636	1,198	1,206
NP	959	1,124			1,888	1,255	1,307
NPK	1,308	1,205			1,948	1,290	1,438
NK	1,259	1,105			1,907	1,232	1,376

the average yield with nitrogen alone. In four fields the 2-year average increase due to potash is 170 pounds of seed cotton per acre.

These results indicate that future fertilizer recommendations for cotton in the foothills area will tend toward a complete fertilizer. It must be borne in mind, however, that these results are for only 1 and 2 years and may be materially changed within the next few years.

The Tung Oil Industry

(*From page* 18)

izer, 4-14-10, applied at the rate of 200 pounds per acre gave a yield of 1,317 pounds of nuts.

Checked against the fertilized plots was an acre of the same age trees on the same type soil and handled with the same care which, relying wholly on the original fertility of the soil, produced only 755 pounds of nuts.

Research in horticulture at the Louisiana State Experiment Station has resulted in tentative recommendation of a 4-8-4 fertilizer for tung oil trees, applied at the rate of 1 pound per year of age of tree until the tree is 4 years old. Like the Poplarville Experiment Station in Mississippi, they recommend the use of legumes, such as soybeans, cowpeas, and crotalaria.

For Future Success

All persons making a study of the possibilities of tung oil as a potential cash crop agree that a lot of experimentation is necessary before any definite value of the industry can be arrived at. Among the things that they are interested in are the segregation and breeding of trees that are high producers; the production of a nut that is high in oil content; the proper methods of planting, cultivating, and fertilizing the trees; and numerous other data that are highly desirable in properly establishing the industry.

Summer and winter legumes have been grown to determine the value of cover crops alone as soil-improvement agents. All have proven beneficial, but the cover crops are being varied in an effort to determine which are giving the best results. "The object," Dr. Robert says, "is to increase the humus content of the soil and the nitrogen turn-over for the tung trees. Check plots, which were not planted to legumes, produced 306 pounds of nuts per acre from trees planted in 1932. On the plots where legumes were grown, 700 pounds of nuts per acre were harvested."

Trees, it is found, grow and produce more satisfactorily when cultivated. Shallow cultivation at intervals of 6 to 8 weeks, depending on the vegetation, reveals a marked increase in growth and production over uncultivated plots.

Tung trees, like any other crop, are affected in growth and production by the quality of the soil. Poor land, minus the necessary plant food, will not produce tung trees profitably. If the kind and quality of plant food is not available, it must be put there in some form if the orchard is to prove profitable. And Dr. Robert states, "the pitfalls of the industry lie in the failure of over-zealous individuals to recognize that good soil and the proper treatment of young and old trees, along with certain natural requirements, are essential in a profitable venture in the production of tung oil."

Care should be exercised in plant-

ing tung trees. They should not be spaced closer than 25 to 30 feet on an equilateral triangle basis. Trees spaced 30 feet apart in this manner would give about 50 per acre, and 25 feet apart, 70 per acre. Since these trees live and grow for a half century or more, if properly handled, ample space should be allowed for them to expand. One 30 years old, is 41 feet tall, has a limb spread of 40 feet, and measures 72 inches in circumference 1 foot above the ground.

It has been found advisable in transplanting tung trees to leave all roots possible. The tap root should be not less than 15 to 18 inches long, and the holes for planting 2 to 3 feet square and 2 feet deep. A few shovels of stable manure or decayed vegetable matter mixed with top soil and placed in the bottom of the hole, the top soil carefully sifted between the lateral roots, and 1½ to 2 gallons of water siphoned around the tree are helpful in getting the young trees away to a good start. A little grass, straw, leaves, or other vegetable matter spread around the tree will aid in keeping the soil moist, and in eliminating baking and hardening.

Young seedlings, as a rule, should be cut back to within 6 or 8 inches of the ground, and only one bud—the strongest one nearest the ground—should be left, allowing only one body from the roots, which will branch from 3 to 5 feet from the ground. One-year old seedlings are normally better than 2-year old ones which require more careful handling than the younger ones.

Unlimited Market

The two major problems of all cash crops, economic production and profitable marketing apply to tung trees. However profitable marketing as far as tung oil is concerned, is solved for many years, in the opinion of Dr. Robert, since the amount of tung oil used is now limited by the amount available. Present use of this oil, if supplied by the American market, would require from 400,000 to

Four-year-old tung tree which produced an extra heavy crop of nuts in 1936. It was cultivated twice a year and planted with a summer cover crop of cowpeas and a winter crop of Austrian peas.

500,000 acres of trees. In addition, the United States annually imports linseed oil, which is inferior to tung oil for paint purposes, and it would require a minimum of 300,000 acres to supplant these imports. Moreover, new uses for tung oil are constantly being discovered by manufacturers, thus opening up new potential demands for the product.

Land Grant Landmarks

(*From page 5*)

ing and engineering, they no doubt "bothered" and bored some individuals beyond measure. But no less a worthy statesman than Henry Wallace himself is particularly disgusted with the methods of the "get 'em quick" squads and their restless lobbying; and if I mistake not, he is listed with those who first grew line-bred hybrids instead of depending on half measures with wind-pollinated mother ears alone. Abolish or crush out rugged individualism and you close new frontiers of scientific truth.

NO complete record could ever be compiled of those who helped carry the ball toward our first land grant college touchdown. Here and there in obscure pamphlets, aged farm journals, yearbooks, and almanacs the names of old heroes of the hoe are uncovered like stray kernels beneath the dust of ancient threshing floors. All one can do is to select for praise a few veterans of the vernal craft and bless the rest vicariously.

Staid burghers rattling over corduroy roads in wagons and chaises shortly after the redcoats decided to do their farming in England were amazed at what they beheld on a hillside meadow near Burlington, N. J. Rubbing the specks from their vision, they halted the nags and gazed again. Woven in rich green hues of rank timothy and fescue, in contrast to a duller, shorter growth of grasses, were the words, "This Has Been Plastered." Maybe they figured that the one who spread the minerals across the meadow was also plastered, just as students remarked about Jefferson's wobbling wall at the University of Virginia.

"Lack-a-day! Methinks this is just another of Ben Franklin's noddy notions," they said, pushing onward to the market place, in some concern over the Postmaster General's peculiar state of mind. They knew the erratic printer was addicted to all manner of cultural kinks on his plantation, such as writing a treatise on gardening and grafting, and bringing into America some roots of a new herb called "rhubarb," unexcelled for a spring tonic to be taken in the pleasant form of pies. And not a few of the gentry in the colonies had Poor Richard's almanac dangling from a kitchen peg.

Apparently the redoubtable Ben did some grafting on the scion of his own house, for his son, William Franklin, kept up the agricultural tradition by further monkeying with nature while he was governor of New Jersey. At any rate, we find him granting the charter to Rutger's (Queen's) college in later years, and this institution claims fame as the first college to branch out under state aid for the folks who got callouses on their hands.

The Franklins helped form the pioneer agricultural body, the Philadelphia Society for Agricultural Promotion, and this group of worthies made quite a ceremony when the first medal ever struck for farm achievement in America was presented with double-barreled oratory to Colonel George Morgan for his neat farm landscape scheme. He and John Stevens, of Hoboken, were the first

men who made the astounding prophecy before 1800: "No subject of rural economy will eventually be of more importance to agriculture than the cultivation of lucerne."

To the north were other restless souls whose zeal for better farming in the mass led them to travel and debate at a time when fees for such services would not keep them in one red flannel suit required for a hard winter. The generous-minded old zealot for better fairs, Elkanah Watson, of Massachusetts, organized his brethren and then sashayed hither and yon over adjacent colonies when hithering and yonning was no limousine luxury.

HIS plans for attracting dirt farmers to exhibit at fairs where the classifications were up to snuff, and therefore something to sneeze at, meant that the spirit of competitive zeal had come to the aid of agricultural education. This has ever since been the best way to get something done in farming—make a contest of it. Nothing so inspires strong men to find better methods than to get the daylight licked out of them in their own business! Even the 4-H clubs use Uncle Watson's idea, and don't know it!

Two other long-sighted men emerged about this time, but far ahead of their era. Both of them outlined clearly the need for an agricultural college under public support, probably the first times this was urged on the slow-witted but nimble-bodied citizenry. Jesse Buel in 1825 petitioned the legislators at Albany for an agricultural college like Switzerland enjoyed; and as a judge and publisher, he exerted wide influence. Much earlier, Thomas Budd, a West Jersey Quaker, advanced the plan of granting the rentals of public lands for the support of farm schools and vocational education. The whole Quaker concept of learning was directed broadly toward reaching the submerged 95 per cent as fast as funds and liberality would permit.

No sketch of this sort would be complete minus a few fancy foreign names. We haven't always accomplished every good and wise project on our own brain power alone. Some hunches have been imported, and, of course, improved upon under our masterly attention. As space is scarce, one only need be mentioned as a contributor to farm education leading eventually to land-grant establishment. But the name is flowery enough to serve for all of them—J. Hector St. John de Crevecoeur of Normandy. He ran two farms as experimental stations in Orange County, New York, and in Sussex County, New Jersey. He wrote voluminously and lectured about his wide and observant travels. Known as "Agricola" to his eager readers, this French savant is said to have introduced sainfoin, alfalfa, and vetch to our shores. I might wedge in one more, a pioneer nurseryman, botanist, and breeder, Andre Michaux, contemporary with the long-named Frenchman. And so return to Yankee notions again.

THE year that George Washington died on his peaceful farm at Mount Vernon, where the annals of Young had been his guiding star, a doughty New Yorker, graduated from Queen's college of New Jersey, stepped to the bat at various times and used his revolutionary war language with effect in asking loudly for an institution where husbandry might be taught as consistently as Plato and Aristotle. Put a wreath on the grave of Simon DeWitt, another booster for land-grant learning.

At the turn of the nineteenth century more people began to expect a different and a better system of training for vocations, as well as a richer background of research so that old

empirical doctrines might vanish. Among the schools that feebly organized themselves to fill this need are: Boston Asylum and Farm School; Rensselaer Institute of Troy; Trinity College, Hartford; Union Academy and Freehold Institute of New Jersey; Amherst College, Massachusetts; the Farmers' College near Cincinnati; and that peculiar, individual academy run by James Mapes of Newark. Mapes was a real promoter, as his graduates scattered over the scenery and advertised in *The American Farmer* and *The Ploughboy* as being prepared to sell their services as "consulting agriculturists." When things get to such a pass it signifies that farming is emerging as a profession.

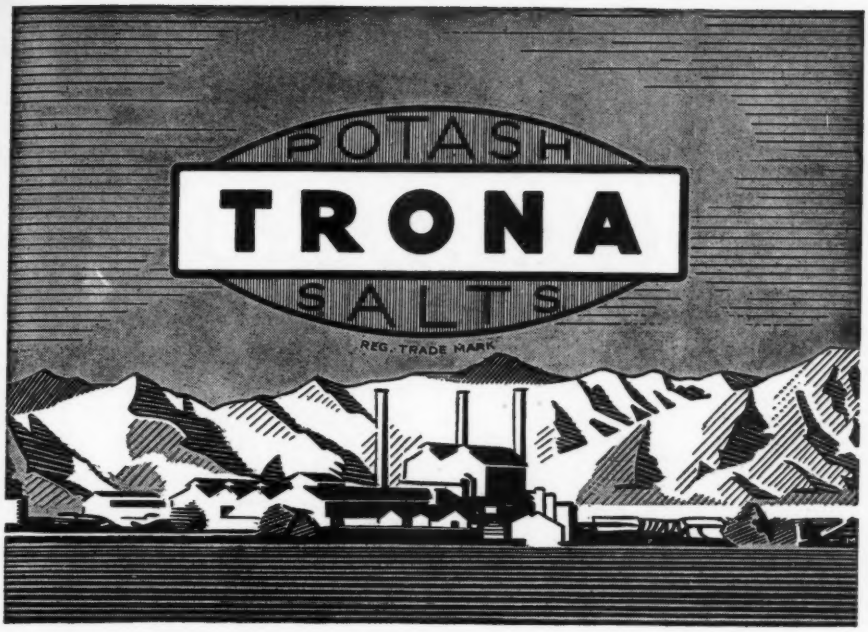
SOME of this eastern, fashionable, farming fever must have been carted across the prairies to the new developments along the Mississippi, for the scene soon shifts to the last ditch struggle that occurred in good old Illinois prior to Lincoln's graceful act in 1862. We must not forget that in the interval a few enterprising states launched forth with limited courses in the arts of food production and mechanics. Among the prominent ones Michigan heads the list. But what everybody wanted was a national policy, a Federal recognition, a move to unite the forces pleading for a better rural culture. As everyone knows, the actual granting of some wild land to colleges provided only a meager sum and an unreliable one at best. It was the principle of the thing that makes us salute this mile-post. The robust farmer and his professors wanted to get their feet wedged into the door. That's all—just a good pushing chance! That they have been successful pushers can be told by the graduates and finances of the fifty or more land-grant institutions doing business today.

When we reach the last furlong of our story, it is perplexing to know whether Jonathan Baldwin Turner of Illinois and Yale, or Justin Morrill of Vermont should be credited with drafting the land grant magna carta. Turner attended a few fiery farm meetings in Illinois and saw to it that the heat was kept under the boilers. He got next to both Senator Douglas and Candidate Lincoln at a period when the promises of honest but ambitious men really meant something. Morrill was equally persistent among his Coolidge Calvinistic fellow New Englanders, who probably wanted to trade off some Government property for a college rather than buy one. For once East and West made a team in double harness for a common agrarian cause. Put that down in red ink in these days when regional farm blocs act like blockheads.

After the first bill of 1857 was vetoed by Buchanan, Morrill removed his coat and vest, snapped his suspenders up tighter, expectorated on his digits, and waded in to educate Congress in earnest, and Turner handled the proletariat. Both Lincoln and Douglas had promised, if elected, to sign the University Bill. Our readers know the contents of said document, which had the vestiges of "state bribery" in it to the consternation of holier folks. I believe Iowa and Vermont and Connecticut were the first ones to be bribed. Iowa has never gotten over it! Her "Ames" for agriculture have been fairly remunerative despite her rashness.

FILES tell me that the Morill Act passed the Senate thirty-two to seven, and the House endorsed it ninety to twenty-five. Nobody saved the pen Lincoln used to sign it. Other pressing business drove mementoes of that kind into the discard, and no flash bulb artists were there to say, "Smile, Uncle Abe; and grin, Mr. Morrill!" History is silent on smiles and congratulations. That is reserved for us!

(Warning—To be continued)



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"BUTTON, BUTTON"

In a crowded bus, a stout woman vainly endeavored to get her fare out of the pocket of her cloak, which was tightly buttoned as a protection against pickpockets. After she had been trying without effect for some minutes, a man seated on her right said:

"Please allow me to pay your fare."

The woman declined with some anger and renewed her attacks on the pocket. After some little time, the man again said:

"You really must let me pay your fare. You have already unbuttoned my suspenders three times."

An Irishman's attic caught fire. His wife, running for the nearest available water, seized the kettle from the fireplace. On her way up the stairs she was met by Paddy. He stared aghast at the kettle in her hand. "Mrs. O'Toole," he said sadly, "but it's a regular fool ye are an' all. Fancy trying to put out a fire with hot water!"

Mandy: "Boy, how did yuh-all get that soot on yo' coat?"

Rastus: "That ain't soot. That's dandruff."

GLADLY

"Mr. Jones, dad wants to borrow your corkscrew."

"All right, sonny," said Jones, reaching for his coat. "You run along home; I'll bring it over."

Golfer (to players ahead): "Pardon, but would you mind if I played through? I've just heard that my wife has been taken seriously ill."

W'en Sis Mandy tell her gal to behave an' have a good time, she say,

"Which you mean, Mammy?"

BLOOD SERGE

A man appeared at the gate of a nudist colony, rang the bell, and waited.

From inside, "What do you want?"

"I want to join."

"You can't join with that blue suit on."

"That isn't a blue suit, sir, I am just cold."

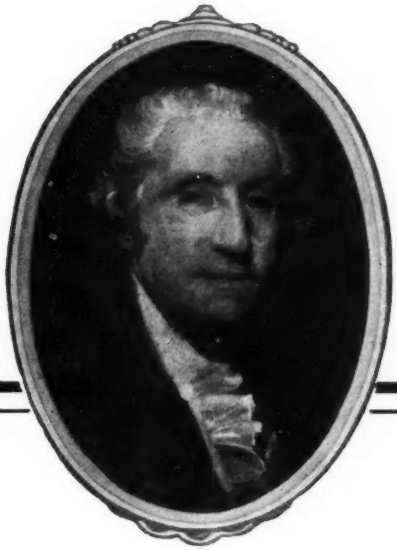
Judge: "Do you wish to marry again if you receive a divorce?"

Liza: "Ah should say not. Ah wants to be withdrawn from circulation."

A woman and child are riding on a Long Island train. As the conductor approaches, the lady opens her purse and says, "A fare for me and a half fare for the boy."

The conductor looks at the boy and replies, "Lady, that boy's got long pants on!"

"In that case," says the lady, "a full fare for the boy and a half fare for me!"



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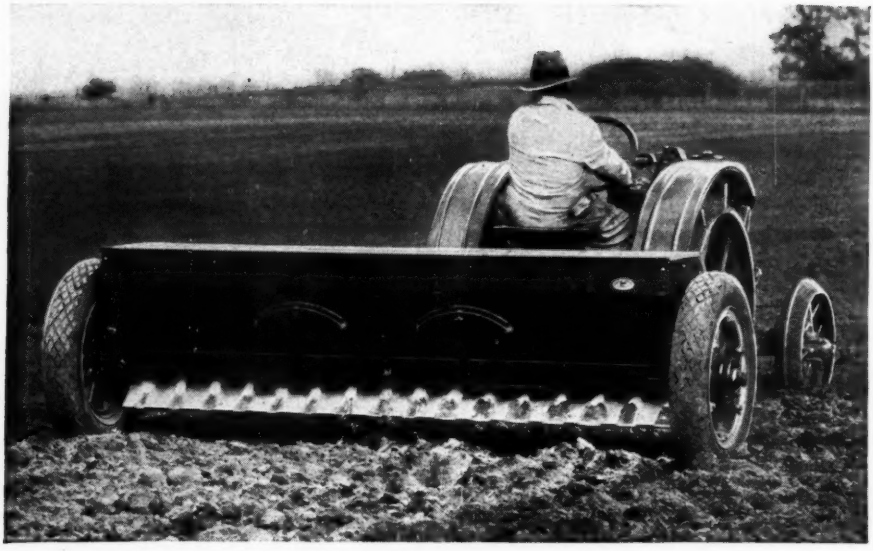

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